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A MANUAL OF BEE-KEEPING

BY

JOHN HUNTER

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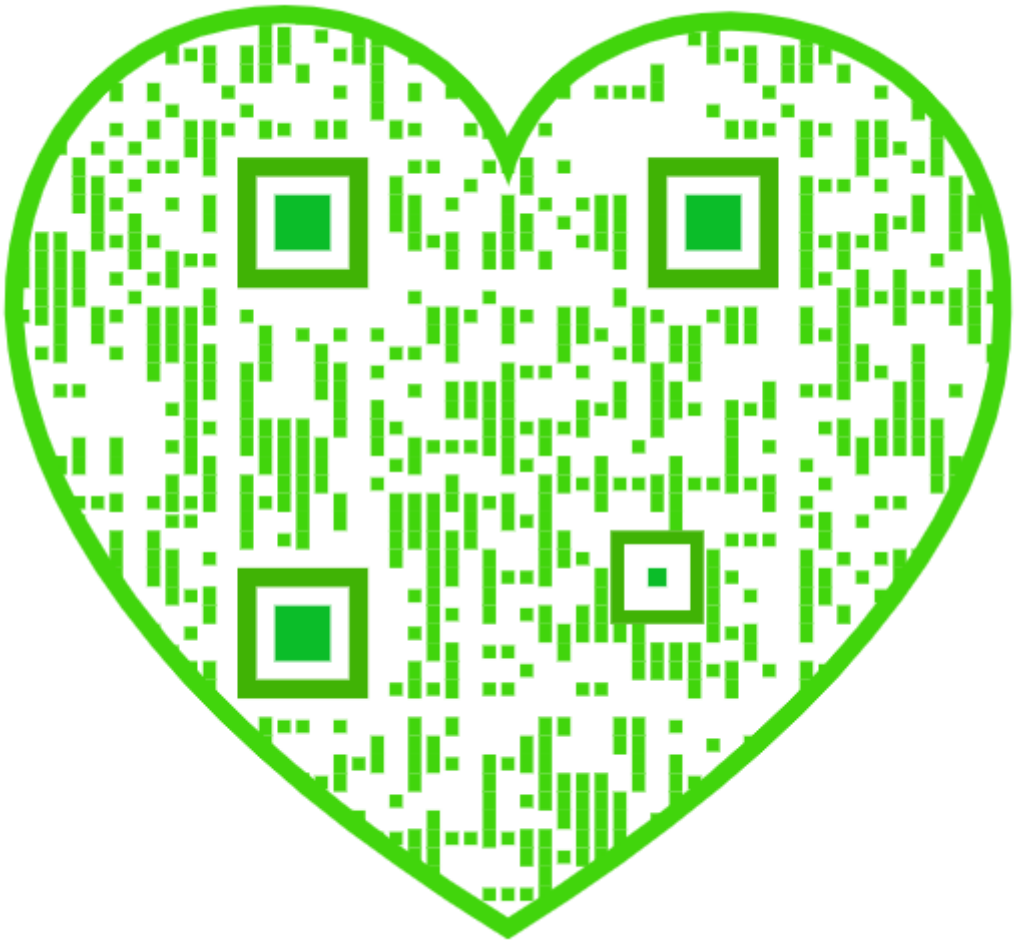

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A

MANUAL OF BEE-KEEPING.

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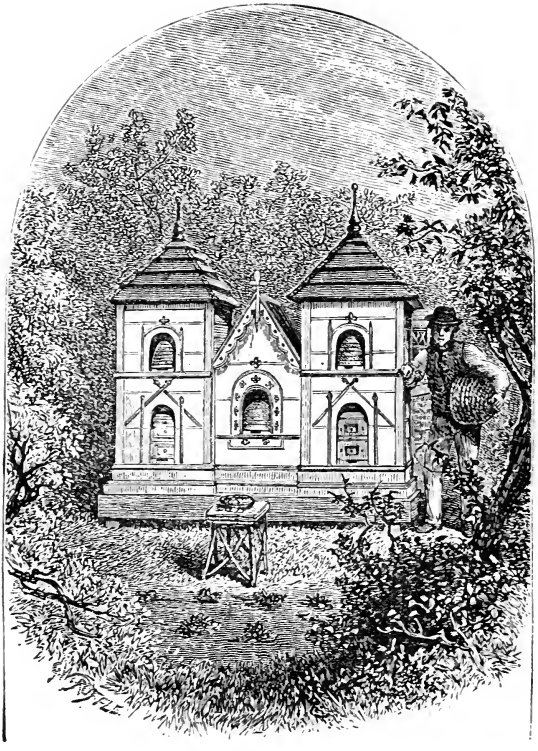
Mr. John Hunter was a beekeeper to Queen Victoria, also he was grandfather of Mrs. Hilda Simpson, a keeper of bees at Port Kells, British Columbia.



BEE PALACE,

EXHIBITED BY C. W. SMITH, ESQ.,

At the British Bee-Keepers' Association First Exhibition, Crystal Palace, 1874.

A

MANUAL

OF

BEE-KEEPING.

BY

JOHN HUNTER,

Honorary Secretary of the British Bee-keepers' Association.

"Some have taught
That Bees have portions of etherial thought,
Endued with particles of heavenly fires,
For God the whole created mass inspires."—VIRGIL.

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1875.

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PREFACE.

—:o:—

In my position as Honorary Secretary of the British Bee-keepers' Association, I have frequently been asked to recommend a moderately priced book, which would instruct the inquirer how properly to manage his Bees; to my great regret I have been unable to give a satisfactory reply. I was acquainted with no work embracing the requisites of cheapness and completeness up to our present standard of knowledge, to bring it within the means of the many. The best work in the English language is unquestionably *Langstroth on the Honey Bee;* but this is published in America, and costs here Ten shillings and sixpence. All others that I knew did not explain the various systems and apparatus sufficiently, or were too costly for general use. It was universally acknowledged that the Apiarian Exhibition of 1874 had given an immense impetus to

Bee-culture, and I had great hopes that one of our clever and learned Bee-masters would have announced during the Winter a new work on the subject, which would fulfil the desired conditions; but the 1st day of February, 1875, arrived, and I had not heard the wished-for news; so, reluctant to let the Spring appear without the needed help, I resolved, *faute de mieux*, to attempt the work myself; and, having sought and found a publisher, began and completed this little Manual in my leisure evening hours of the month of February. This I must beg may excuse any deficiencies that may be discovered.

My work is very unpretentious. I am fully aware there are many shortcomings, possibly errors, in it; and I am perfectly conscious of my inability to do justice to my task, for I may at once say I make no pretence to originality, therefore have not scrupled to extract from the writings of previous authors any drawings or matter where I felt myself unable to improve on them. I have been particularly indebted in this way to *Langstroth on the Honey Bee, The*

British Bee Journal, the articles of Mr. Cheshire, in *The Country*, *The Journal of Horticulture*, *King's Bee-keepers' Text Book*, and *Neighbour's Apiary*. I have, I believe, in most cases acknowledged the author from whom I have borrowed. If, in any instance, this is omitted, it is unintentionally; therefore I hope to be pardoned. My aim has been to make known the various new inventions and appliances in apiculture, and to encourage the culture of the Bee, by showing what wealth is lost to the nation at large by its neglect and to give in a popular and handy form practical instructions to the novice which may start him fairly on the road to profitable Bee-keeping in a merciful and rational manner. Is it too presumptuous to hope, also, that the adept may herein find some useful hints and facts with which he was not acquainted? Earnestly trusting that my work may not be in vain,

I am, &c.,

JOHN HUNTER.

5, Eaton Rise,

Ealing, Middlesex.

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A MANUAL OF BEE-KEEPING.

NATURAL HISTORY OF THE HONEY BEE.

"What atom forms of insect life appear!
And who can follow Nature's pencil here?"—MRS. BARBAULD.

FROM the very earliest historic times, the Hive Bee has been cultivated by man for the sake of the delicious honey and useful wax that it produces, as well as studied for the manifold lessons it furnishes in industry and physiology.

The busy merchant, when wanting a symbol of industry for his house, could find no better sign than the "Bee-hive." How common the axiom, "A very Hive of Industry." The poet and the moralist fails not to quote our little friend as an example to the young; and the beautiful hymn of Dr. Watts, of "The Little Busy Bee," can never be forgotten as a memory of our early days, and in ages to come will be taught to our children's children with the same loving wish of a good result as was hoped for us.

To the naturalist and man of science, the Bee affords a never ending store of Nature's wonders; although philosophers, from Aristomachus, four centuries before the Christian era, Cicero, Pliny, Philiscus, Virgil, Theophrastes, Plutarch, and Columella, to those of

modern times, Miraldi, Reaumur, Sir Christopher Wren, and the illustrious blind Huber, all wrote upon and studied the Bee, the wonders it unfolds are not yet exhausted.

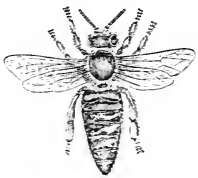
The limits of this little work will not permit me to go very deeply into physiology, but an understanding of this subject to some extent is quite necessary to all who would comprehend the why and wherefore of many important facts which I shall have to mention as I proceed. In Great Britain and on the Continent of Europe there is cultivated, so far as I know, but one species of Hive Bee, although of this there are several varieties. Our common English, or Black Bee, has been scientifically named *Apis Mellifica;* and the Italian, or Ligurian Bee, *Apis Ligustica;* but all entomologists agree that they are one and the same species.

Dr. Gerstacker even goes so far as to consider the Egyptian Bee *Apis Fasciata*, and another African Bee *Apis Adansonii*, as varieties also. The best authorities are in a difficulty as to which Bee should rank as the species—whether to say *Apis Mellifica var Ligustica* or *vice versa*. The former, I think, is the more generally adopted; but our distinguished hymenopterist, Mr. Frederick Smith, of the British Museum, seems to consider the most highly coloured as the typical form; and it is possibly more correct to give the precedence to *Apis Ligustica*, but it cannot be decided satisfactorily until we know in what country *Apis Mellifica* really originated.

Physiologically I can detect no difference between Ligurians and Black Bees. Individuals vary in size as well as in colour; but, on dissecting a number of each variety, the difference is nil, and no microscopist could

separate a series of any given organs of both, if mixed indiscriminately. A hive of Bees in June consists of three different kinds of individuals, viz.: a Queen, Workers, and Drones.

Worker.
Fig. 1.



Queen.
Fig. 2.

Drone.
Fig. 3.

In abnormal circumstances, the first and last of these may be absent, the second never. The Queen is the only *perfect* female.

> "First of the throng and foremost of the whole,
> One stands confest the Sovereign and the soul."—VIRGIL.

If the colony has not swarmed, the mother of every other Bee in the hive is the Queen, and who is the only means by which the population can be kept up or increased. But *one* Queen is allowed to exist in each hive, although one or two exceptional cases have been recorded where this almost invariable rule has for a short time been broken. Her shape is widely different to that of the other Bees. She is not nearly so bulky as a Drone, but her body is longer and considerably more tapering, more so even than that of a Worker. Her abdomen is also generally lighter in colour than the other Bees; and when she has fully entered upon her duties as a Matron, her movements are slow and majestic, and she can rarely be induced to take wing. The sole business of the Queen is to lay eggs. No part of the work of the hive is done

by her, and she is usually found surrounded by many of her subjects standing in a circle, with their heads towards her, ready to clean, feed, or otherwise attend to her and take care of the deposited eggs. Whenever her majesty changes her position, the Bees make way for her, always closing round and keeping the circle up, allowing free space for her movements in the centre. The sight of a Queen thus attended is one of the most curious and interesting things in a hive. The Queen has a sting, but has never been known to use it, except in combat with another Queen. The Workers form the bulk of the population, and are the smallest Bees in the hive. They are furnished with an exceedingly curious tongue, with which they obtain honey from the flowers and convey it to their mouth, whence it passes to the honey bag to be afterwards ejected into the cells. The hind legs of the Workers are furnished with a spoon shaped hollow, called the "Pollen Basket," in which they convey that material to the hive. The length of life of a Worker Bee is determined by the amount of work it does, and the introduction of Ligurian Queens at various seasons enables us to determine this question with almost certainty. After the introduction of a fertile Ligurian Queen to a colony of Black Workers in May, if we examine the hive two months subsequently, we shall find very few Black Bees remain, all having died and been replaced with Ligurians; and as, probably, at the time the strange Queen commenced her reign, some eggs or young larvæ of her predecessor remained, we may conclude then that six weeks is the limit of time a Worker Bee will live in summer. Should the new Queen be introduced in October, not until April following will the same state of affairs be

found; so that it is evident the quietude and rest of winter prolongs the Bee's life fourfold.

> "Another race the spring and fall supplies,
> They droop successive and successive rise."—EVANS.

According to Reaumur, there are 5,376 Workers in each pound weight, and the celebrated John Hunter counted 2,160 in an imperial pint. A populous hive will often contain 40,000 or 50,000 Workers, whose part in the economy of the colony is, as their name implies, *to work*—by them all the labour is done: honey gathered, wax made, combs built, young tended, in fact, everything that requires work is accomplished by the Workers. These Bees are barren, or more properly speaking, not fully developed females, which may be proved on dissection, the organs of their sex being easily discoverable, although not in a fully developed state. Workers have a sting, which they are ever ready to use on an enemy, even though, as is usually the case, their lives pay the penalty, for, being barbed, the sting is retained in the wound and drags out with it part of the Bee's intestines. The Drones are the males, whose sole office is to fertilize the young Queens. They are much stouter than either the Queen or the Workers, but do not exceed the Queen in length. They have no sting with which to defend themselves, no basket on their legs for pollen, no excretory organs for wax, and no suitable tongue for gathering honey from the flowers. Under ordinary circumstances, they only exist in the summer, when young Queens may be expected to emerge; and a colony having sent forth its compliment of swarms, the Drones are immediately slaughtered by the Workers; they accomplish this butchery by biting, teasing, and starving their unfortunate brothers, for

they seem to know that if they use their stings they themselves will die. Often a Drone may be seen with two or more Workers gnawing at his wings and legs, then, thrown from the hive, he perishes for want of power to rise again; and while the massacre is in full progress, the floor of the hive may be found covered with wounded Drones in various stages of starvation, kept there by the Bees until they die or can be thrown out. The number of Drones in a hive varies considerably from 100 or 200 to some thousands.

> "The sad-ey'd justice with his surly hum,
> Delivering o'er to executors pale,
> The lazy, yawning Drone."—SHAKESPEARE.

The egg of a Bee is of a pearly white; it is slightly curved, and in length several times greater than in breadth; it is deposited on the bottom of the cell on its end, and stands somewhat obliquely; there is no difference either in size or colour in Drone and Worker eggs, *and any Worker egg may be made to produce a Queen at the will of the Bee-master.* To the uninitiated, this statement looks fabulous; but I will presently endeavour to show so clearly how it is possible, that I think the most incredulous must be convinced. I will even go further, and state my belief that eggs may be taken which, uninterfered with, would produce Drones (males), and that it is in the power of the skilful scientific Apiarian so to act, that at his will they shall produce either Queens, Drones, or Workers! When we observe a Queen in the act of ovipositing, we see her put her head into a cell, remain a second or two, apparently inspecting the future cradle, to see that all is in order, then, withdrawing her head, she curves her body down into the cell, turns half round, and, retiring, leaves an egg behind her. When she

lays a considerable number, she does it equally on exactly opposite sides of the comb, thus concentrating and economising heat for the development of the brood. Three or four days afterwards, the egg is hatched, and a small white larva or caterpillar makes it appearance; it lies coiled up, and floats in a whitish transparent fluid, which is deposited in sufficient quantity by the Workers, and which forms its nourishment. It grows until the two extremities meet and form a ring, and about the fifth or sixth day it occupies nearly the whole length and breadth of the cell.

The Bees now seal over the cell with a cover made of wax and Bee-bread, whose colour matches that of the surrounding old combs. This cover is convex, that of the Drone cells more so than that of the Workers, and minute holes in it admit air to the larva. Like most other insects, the larva having completed its growth spins round itself a whitish silky cocoon, in which it undergoes the change to a pupa or chrysalis, and eventually in due time appears at maturity as an *imago*, or perfect insect; Workers in twenty-one, Drones in twenty-five days.

For some time after Bees emerge from the pupa state, they employ themselves within the hive as Nurses and comb builders; they may be readily distinguished by a greyish bloom they appear to wear. The period of their seclusion, before they commence honey gathering, varies from a few days to two or three weeks, according to the season.

> "With fond attention guard each genial cell
> And watch the embryo, bursting from the cell."—Evans.

The foregoing description applies to Workers and Drones, but not to Queens; these latter are only reared

by the Bees when they are Queenless, or when Queens are likely to be wanted in swarming time. Suppose, however, that from either of these causes a Queen is required—there are no such things as Queen eggs except in the general sense—the eggs of a Worker or young Worker larvæ not more than three days old, will furnish material with which the Bees can raise their Queens. A certain number of these eggs or larvæ are selected by the Bees if they have them, by the Bee-master if they have not; in the latter case a piece of comb containing them must be supplied as described more fully under the chapter "Queen-breeding;" round these the Workers will immediately build large cells of a totally different form from the ordinary Worker or Drone cells, cutting away all other cells that stand in their way; and to the young larvæ therein, they will supply a much larger quantity of food of a highly nitrogenous character called "Royal Jelly," in a thick bed of which the larva may be seen lying; the effect of this is, that a total change takes place in the development of the Bee, and in five days less time than would have been occupied in maturing a Worker, the Queen emerges to fulfil her allotted destiny as the future mother of an immense family.

If the Apiarian introduce a small quantity of this "Royal Jelly" from a Queen cell, into a Worker cell, containing a young larva, it is said the Bees will rear that selected larva into a Queen, and a phenomenon that sometimes happens in a hive when a Worker is found, which is sufficiently fertile to oviposit, is surmised to occur from the Bees having partly fed it, when a larva on Royal Jelly, causing a greater development of its sexual organs, but yet not sufficient to constitute a

Queen. These fertile Workers only produce Drones, and they are sometimes a great nuisance in a hive, and from the impossibility of distinguishing them from the other workers they are difficult to remove. Mr. Rorl suggests that the Bees should be driven and removed away from their stand, and allowed to fly home; the fertile Worker never having before flown would not know her way home, and would be probably lost.

The fertility of the Queen Bee is enormous; in this respect, some greatly exceed others; a young Queen will usually lay more eggs in a given time than an old one, which is only according to the natural order of things. In the height of the summer season, with combs in good order, a Queen will lay 2,000 to 3,000 eggs per day, and she lives four or five years.

If a Queen Bee be dissected, in her abdominal cavity will be found, in juxtaposition, a pair of organs called "the Ovaries;" these are composed of a multitude of tubes styled "the Ovigerous Tubes," all full of eggs in every stage of growth, from the full-sized egg just ready to lay, to those that are yet very minute. All these tubes lead to a channel called "the Oviduct," each ovary having its own duct;

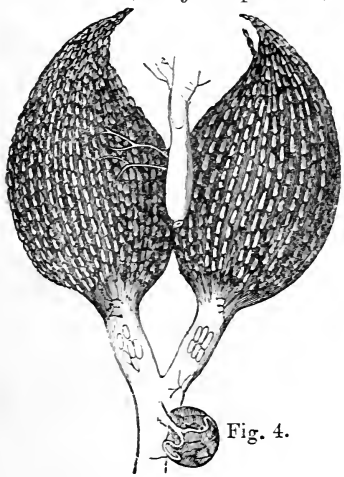


Fig. 4.

but these soon unite into one common channel; just below this junction is a little globular sac called "the Spermatheca," about 1-33rd of an inch in diameter, covered with a beautiful white network of tracheæ, or air tubes, and communicating by a small open duct with the main oviduct, before the mouth of which every egg must pass on its passage to the cell. Like the females of all insects, the Queen Bee has sexual intercourse but once in her life, and in the act of union with the Drone this little sac is filled with the seminal fluid by an infinitesimal portion of which each egg destined to produce a Worker or Queen becomes fertilized by the penetration of the egg's substance by one or more spermatozoa; every egg that does not become so fertilized is not barren or addled, but produces a Drone, and the Queen seems to have the power to prevent the fertilization of her eggs at her will, although how this is accomplished has not been satisfactorily determined. It has been suggested that the extrusion of the seminal fluid from the spermatheca requires abdominal pressure, which the construction of Worker cells affords, and the larger size of the Drone cells does not; this theory has been combatted by saying the Queen will often lay eggs on the floor of cells whose walls are not yet built; but I do not know that it has been proved that these eggs were allowed by the Bees to hatch; and it is well known where eggs are dropped or placed in undesirable places they will eat them.

To demonstrate that unfertilized eggs will hatch and produce Drones, and Drones only, is easy. Observation has proved that unless a young Queen becomes impregnated during the first three weeks of her life, she

becomes incapable of receiving impregnation; and though she continues laying, all her eggs produce but Drones; a Drone-breeding Queen is a common occurrence in an apiary of any extent, and is of course a misfortune, as no Workers being forthcoming to replace the dead, the colony will become extinct. And, again, if for the sake of experiment the Apiarian late in the autumn causes the Bees of a hive to rear Queens, which I have shown can be easily done, there being no Drones about, impregnation becomes impossible, and the Queen becomes a Drone breeder. These facts are taken advantage of by breeders of Ligurian Queens, who contrive to keep Queens in their apiaries who breed nothing but Drones, and so they have abundance ready to fertilize late-bred Queens when they would otherwise naturally be unable to meet with a mate.

To dissect out the spermatheca of a Queen is an easy task to any one who has a moderately delicate sense of touch and a microscope. It is only necessary with a couple of needles to separate the last two or three segments of the abdomen, and with the needles turn out the contents on a slip of glass. With a magnifying glass may now be found the little sac of a whitish-yellow colour; and with the assistance of a microscope this should be placed on a small drop of warm water previously put on a clean glass slip, crushed with a needle and immediately covered with a thin glass cover, now under a quarter of an inch objective; if the Queen was impregnated the characteristic contorted movements of the spermatozoa may be seen in countless thousands forming a strange and wonderful sight. The spermatheca of a virgin Queen contains only a transparent fluid. I have verified the impregnation of a Queen

Bee months after her decease by simply soaking her abdomen in water for a few hours, when the spermatozoa may be easily found. My illustrious namesake, John Hunter, the great anatomist, in conjunction with Sir Everard Home, performed a series of experiments in attempting to impregnate the eggs of Bees and other insects after they had been deposited by the female; he succeeded with the Silkworm Moth but failed with the Bee. The facilities we have now for such experiments are many times greater than he had; and I believe it possible that if eggs freshly laid in Drone cells be removed to Worker cells and then touched with a small camel-hair pencil, previously dipped in *diluted* seminal fluid obtained from the spermatheca of a Queen, the sex of the future young would be changed from male to female; and if so, Queens or Workers could be reared from them. Since I first broached this subject, I have read that Dr. Donhoff, of Germany, in 1855, reared a Worker larva from a Drone egg which he had artificially impregnated, and Langstroth tried the same experiment and failed, but he appears to have left the eggs in the Drone cells contrary to the plan of removal I suggest. Professor Siebold dissected a number of Worker eggs, and found in each from one to three spermatozoa, while he found none in Drone eggs.

This theory of Parthenogenesis, or virgin breeding, in the Honey Bee, was first promulgated by Dzierzon in 1845, and has since been so abundantly verified that there remains not a shadow of a doubt as to its correctness. A Drone-breeding Queen, if unable to find Drone cells sufficient, will lay her eggs in Worker cells; the Bees produced will be perfect Drones but smaller,

dwarfed by the size of the cells which could not contain a full-sized Drone.

Considering the multitude of Drones produced in a hive, and the few Queens, speculation naturally arises why this should be. I can only imagine that God in his unfathomable wisdom has so ordained it in order that the impregnation of the Queen, the life and soul of the hive, should be more certainly secured. Six or seven days after the Queen is born, she issues from her hive, takes wing, and after a good look at her home and its surroundings, for after recognition, speeds with rapid pinions on her nuptial excursion far away out of sight. Why should she do this when her own hive teems with Drones? Shortsighted man! Do you forget the law of Nature, that forbids the mingling of kindred blood without due penalty? Did she mate at home, the usual result of breeding in and in would ensue, and in a few generations the breed would perish; but by flying far away she introduces fresh blood, and her progeny is the more vigorous. Breeders of Ligurian Queens soon find difficulty arise in keeping up the pure breed from the frequent Mesalliances of their Queens. It is said Drones will fly four miles away from home. If Drones were not bred in large numbers, how poor would be the chance of a successful termination to her majesty's excursion. Should the Queen be unsuccessful, she will go out again and again, sometimes, alas! failing to find her way back, or perhaps getting picked up by a bird; in either case, if the stock has no eggs of sufficiently young larvæ, and the state of affairs be not quickly discovered and remedied by the Bee-master, the fate of the colony is settled, it dwindles and dies. If, on the contrary, the

Queen returns impregnated, she in two days usually commences her maternal duties, and never more leaves home until she accompanies a swarm and founds a new family. In populous and healthy stocks, young larvæ or eggs may be found at least ten months in each year.

The possession of a hive of Bees affords a fund of material by which many instructive and amusing experiments may be carried out, and by which facts in natural history may be brought to light, perhaps small in themselves, but great in the aggregate.

Sir John Lubbock has initiated such experiments in endeavouring to arrive at a knowledge of how far Bees are endowed with power of communicating intelligence one to another—his conclusions are not very favourable to the Bees; I give the Bees more credit for that power than he does, but have made no special observations to demonstrate the point. In a paper communicated to the Linnean Society, Sir John Lubbock says: "It "will be observed that the current statements with "reference to the language of social insects, depend "much on the fact that when one of them, either by "accident, or in the course of its rambles, has discovered "a stock of food, in a very short time many others arrive "to profit by the discovery. This, however, does not "necessarily imply any power of describing localities. "If the Bees or ants merely follow their more fortunate "comrade, the matter is simple enough; if, on the "contrary, others are sent, the case becomes very "different.

"In order to test this, I proposed to keep honey in "a given place for some time, to satisfy myself that it "would not be readily found by the Bees, and then after "bringing a Bee to the honey, to watch whether it

"brought others, or sent them—the latter of course "implying a much higher order of intelligence and "power of communication.

"I therefore placed some honey in a glass, close to an "open window in my sitting room, and watched it for "sixty hours of sunshine, during which no Bees came "to it.

"I then, at ten o'clock, a.m., in the month of June, "went to my hives and took a Bee which was just "starting out, brought it in my hand up to my room "(a distance of somewhat less than 200 yards), and "gave it some honey which it sucked with evident "enjoyment. After a few minutes it flew quietly "away, but did not return; nor did any other Bee "make its appearance.

"The following morning I repeated the same experi- "ment. At 7·15 I brought up a Bee which sipped "the honey with readiness, and after doing so for about "five minutes, flew away with no appearance of alarm "or annoyance. It did not, however, return, nor did "any other Bee come to my honey.

"On several other occasions I repeated the same "experiments with a like result. Altogether, I tried it "more than twenty times; and I am satisfied that these "Bees cannot all have lost themselves or met with "accidents. Indeed, I never found Bees to return if "brought any considerable distance at once. By taking "them, however, some twenty yards each time, they "came to the honey. I at length trained them to "come to my room. On the whole, however, I found "it more convenient to procure one of Marriott's "observatory hives, both on account of its construc- "tion, and also because I could have it in my room,

"and thus keep the Bees more immediately under my "own eye. My room is square, with two windows "on the south-west side, where the hive was placed, "and one on the south-east. Besides the ordinary "entrance from outside, the hive had a small postern "door opening into the room; this door was provided "with an alighting board and closed by a plug; as a "general rule, the Bees did not notice it much unless "the passage was very full of them.

"I then placed some honey on a table close to the "hive, and from time to time fed certain Bees on it. "Those which had been fed soon got accustomed to "come for the honey; but, partly on account of my "frequent absence from home, and partly from their "difficulty in finding their way about, and their ten- "dency to lose themselves, I never could keep any marked "Bee under observation for more than a few days."

A little dab of oil or water-colour, put on with a pencil on the insect's thorax or abdomen, will be found an efficient mark, and not difficult to apply when the Bee is engaged feeding.

That Bees can see of course does not admit of doubt. When a Bee leaves her hive for the first time, she flies backwards and forwards several times with her head turned towards it—evidently taking its bearings for recognition; and then, however far she flies, returns straight home; now if before her return the appearance of the hive be altered, she becomes evidently confused, but eventually enters; if the hive be moved but a few inches, she gives the same indication of doubt, and will, if possible, alight on the old spot several times before she discovers her old home; the acuteness of her sight does not, as we should think would be the

case, direct her at once to the hive she has been accustomed to, but I should rather say it is instinct that guides her to the old spot. Sir John Lubbock, who has experimented very patiently on the senses of Bees, took considerable trouble to ascertain if Bees can distinguish colour, and he comes to an affirmative conclusion by the following experiments: He placed some honey on slips of glass, resting on black, white, yellow, orange, green, blue and red papers; a Bee, which was placed on the orange, returned twenty times to that slip of glass, only once or twice visiting the others, although the position and also the honey were moved. The next morning, two or three Bees paid twenty-one visits to the orange and yellow, and only four to all the other slips of glass. The glass was then moved, after which, out of thirty-two visits, twenty-two were to the orange and yellow. That they can distinguish blue was indicated by the following experiment:—

The colours were ranged in a line, with blue at one end. It was a cold morning, and only one Bee came; she had been several times the preceding day, generally to the honey which was on the blue paper. This day, also, she came to the blue; the blue was moved gradually along the line, one stage every half hour, during which time she paid fifteen visits to the honey, in every case going to that which was on the blue paper. The experiments seem pretty conclusive; but how is it that English Black Bees do not kill strange Ligurians when two lots are united, if the characteristic odour of each has been destroyed? slaughter would undoubtedly have taken place, had the strangers been introduced without this precaution. They do not appear to notice the colour of the strangers.

Naturalists have many times observed that insects, ants especially, communicate intelligence one to the other by crossing their antennæ; and Huber has proved satisfactorily that in Bees these organs have the same use. He wished to ascertain whether, when the Bees had lost a Queen (intelligence of which traverses a whole hive in about an hour), they discovered the sad event by their smell, their touch, or any unknown means. He first divided a hive by a grate which kept the two portions about a quarter of an inch apart, so that they could not come at each other. Though scent would pass in that part in which there was no Queen, the Bees were soon in great agitation, and as they did not discover her where she was confined, in a short time they began Queen cells which quieted them. He next separated them by a partition through which they could pass their antennæ but not their heads; in this case the Bees all remained tranquil, neither intermitting the care of the brood, nor abandoning their other employments, nor did they begin any royal cell. The way they assured themselves that their Queen was in the vicinity, and to communicate with her was, to pass their antennæ through the openings of the grate. An infinite number of these organs might be seen at once, as it were, seeking in all directions, and the Queen was observed answering these anxious inquiries of her subjects in the most marked manner, for she was always fastened by her feet to the grate, crossing her antennæ with those of the inquirers. That the antennæ of insects are organs of intelligence is generally admitted, but in what manner intelligence is communicated has never been determined, probably through a sense of which we know nothing, and never

shall, any more than light can be comprehended by those born blind. The olfactory sense is highly developed in Bees; by it they discover food, and know one another. But the sense of hearing is, probably, not very acute. The piping of an imprisoned Queen appears to be heard by the reigning monarch, as she seems to answer it; but Sir John Lubbock, in relating his experiments, tells us that with the utmost efforts he could make with tuning-forks, whistles, violin, or shouting close to the head of the Bee, when all around was still, he never could obtain the slightest indication that the sounds were heard.

The visits of insects to flowers are of great importance in transferring the pollen from the stamens to the pistil, which are often situated in different flowers; and without some such aid, fertile seed could not be produced.

> "Go sip the rose's fragrant dew,
> The lily's honied cup explore,
> From flower to flower the search renew,
> And rifle all the woodbine's store."

Darwin, in his *Origin of Species*, says, that red clover is wholly fertilized by Humble Bees, and as in Australia there are none, there they can never raise red clover seed. The Honey Bee plays a conspicuous part in this distribution of pollen, being incessantly engaged in rifling the flowers; it becomes dusted with pollen which, adhering to the hairs with which the Bee is covered, is carried from flower to flower. Sir John Lubbock in his work *British Wild Flowers in relation to Insects*, says: "To the honey are due the visits of insects; the "sweet scent and bright colours of the flowers attract "them, the lines and circles on the corolla guide them "to the right spot. While from time immemorial we

"have known that flowers are of great importance to "insects, it is only comparatively of late that we have "realised how important, indeed, how necessary insects "are to flowers. For it is not too much to say, that "if on the one hand flowers are in many cases necessary "to insects, insects on the other hand are still more "necessary to the very existence of flowers; that if "insects have been in many cases modified and adapted, "with a view to obtain honey and pollen from flowers, "flowers in their turn owe their scent and colour, their "honey and even their distinctive forms to the actions "of insects. There has thus been an interaction of "insects upon flowers, and of flowers upon insects, "resulting in the gradual modification of both. Though "bright colours and strong odours are sufficient to "attract the attention of insects, something more is "required. Flowers, however sweet-smelling and "beautiful, would not be visited by insects, unless "they had some inducements more substantial to "offer. These advantages are the pollen and the honey. "The honey is secreted sometimes by one part of the "flower, sometimes by another; and great variations "may be found in this respect even within the limits "of a single order. It is a remarkable fact that "in most cases Bees confine themselves in each journey "to a single species of plant." Thus the grand law of Nature forbidding the union of relatives is carried out by Bees, who by their visits from field to field, and flower to flower, give fertility and vigour to vegetable life.

"Oh, Nature kind! oh, labourer wise!
That roam'st along the summer's ray,
Gleau'st ev'ry bliss thy life supplies,
And meet'st prepared thy wintry day,

Go, envied go—to crowded gates,
Bear home thy store in triumph gay,
The hive thy rich return awaits
To shame each idler of the day."—SMYTH.

Messrs. Kirby and Spence, in their admirable work, thus describes a Bee's operations on a flower when gathering nectar :—

"Observe a Bee that has alighted upon an open "flower. The hum produced by the motion of her "wing ceases, and her employment begins. In an "instant she unfolds her tongue, which was before "rolled up under her head; with what rapidity does "she dart this organ between the petals and the "stamens! At one time she extends it to its full "length, then she contracts it; she moves it about in "all directions, so that it may be applied both to the "concave and convex surface of a petal, and wipe them "both, and thus, by a virtuous theft, robs it of all its "nectar. All the while this is going on, she keeps "herself in a constant vibratory motion. The object "of the industrious insect is not like the more selfish "butterfly, to appropriate this treasure to herself. It "goes into the honey bag as into a laboratory, where it "is transformed into pure honey; and when she returns "to the hive she regurgitates it in this form into one "of the cells appropriated to that purpose, in order "that after tribute is paid from it to the Queen, it "may constitute a supply of food for the rest of the "community."

"How oft, when wandering far and erring long,
Man might learn truth and virtue from the Bee."—BOWRING.

Virgil asserted, "a Bee is a ray of divinity;" and when studying with awe the wonders of the Bee-hive, so beautiful in their simplicity, so perfect in their ends,

can we fail to acknowledge the presence of that All-guiding Hand, who, by these little insects and all their wondrous works, teaches man a lesson of industry, forethought and order, the contemplation of which inspires such veneration as may induce us to follow more closely the behests of Him, without whom is naught? Shall we not join in the awe-inspiring words of the Poet Derzhazin :—

"In its sublime research, philosophy
May measure out the ocean deep—may count
The sands or the sun's rays—but, God! for Thee
There is no weight, nor measure:—none can mount
Up to Thy mysteries!—Reason's brightest spark,
Though kindled by Thy light, in vain would try
To trace Thy counsels infinite and dark;
And thought is lost ere thought can soar so high
E'en last moments in eternity!
Thou from primeval nothingness dids't call
First chaos, then existence. Lord, on Thee
Eternity had its foundation!—All
Spring forth from Thee!—All light, joy, harmony!
Sole Origin!—All life, all beauty, Thine!
Thy word created all, and doth create—
Thy splendour fills all space with rays divine!—
Thou art and wert, and shall be—glorious!—great!
Life-giving, life-sustaining Potentate!"

BEE-KEEPING.

" As each for the good of the whole is bent,
And stores up his treasures for all,
We hope for an evening, with hearts content,
For the winter of life without lament.
That summer is gone with its hours misspent,
And the harvest is past recall!"—Dr. Aikin.

A Traveller who has much acquaintance with continental rural life, cannot fail to be impressed, when journeying in England, with the small number of Bee-hives he sees scattered about, amongst either the cottages of the labouring classes, or the farms and courts of the gentry, compared with what he sees abroad; and when, perchance, his eye alights on a hive or two, he will nine times out of ten find only the ancient straw skep in use, and that probably badly made. The rustic mind, although now used to the innovation of steam ploughs and thrashing machines, has been quite content to jog on with his Bees in the same manner that his Saxon forefathers did a thousand years ago. But what a life, and *what a death* for the poor Bees! the hives are probably reeking with moisture, dirty and decayed, and when the industrious labourers have, in spite of all such disadvantages and neglect, filled them with Natures luscious gifts, the fate in store for them is suffocation, with the horrible fumes of brimstone; and this procedure is not practised by the poor and ignorant only, but in many cases adopted by

the educated and opulent if, by chance, they own a few Bees.

"Ah! see where, robbed and murdered in that pit,
Lies the still-heaving hive at evening snatched,
Beneath the cloud of guilt concealing night,
And fixed o'er sulphur while not dreaming ill,
The happy people in their waxen cells,
Sat tending public cares.
Sudden, the dark, oppressive steam ascends,
And used to milder scents the tender race,
By thousands tumble from their honied dome,
Into a gulf of blue sulphurous flame."—THOMSON.

Oh, ye large-hearted Philanthropist, Gentle Lady, and Reverend Pastor, whose charitable hearts would faint with horror at the like tortures inflicted on creatures of a larger growth. Why do you permit this? especially as such practices are, independent of the cruelty to the Bees, wasteful, costly, and unnecessary. To the honour of the Clergy, be it said, they as a class far outnumber all others who have adopted the modern methods of merciful Bee-keeping. *Tell* an ignorant labourer that his honey can be got from the hive, his Bees preserved to work for him again, and that no more honey will be required to feed 20,000 than 10,000 little mouths during the winter, and you would simply elicit an incredulous smile, he certainly would not be induced to try, however lucidly the process was explained; but *show him how to do it*, let him see the result, and he will another year, perhaps, follow the example set, greatly to his own benefit as well as to that of his Bees. To all Bee-keepers who are thinking men or women, I commend my little book, which, carefully studied, will give every necessary instruction by which they may become accomplished Apiarians, and a centre of knowledge for the enlightenment of others.

Associations and societies for the encouragement of agriculture, horticulture, and various other sister sciences, have for many years abounded in England, but it was reserved for 1874, to see the establishment of the first one for the encouragement and promotion of Bee-keeping, when the British Bee-keepers' Association, presided over by Sir John Lubbock, sprung into existence, through the exertions of nearly all our own leading Apiarians, whose observations and writings have contributed so largely to apiarian science. The Association did me the honour to elect me Honorary Secretary, and the member's small annual subscription of five shillings, supplemented by liberal donations for a prize fund, enabled the Committee to hold an exhibition at the Crystal Palace, in September, 1874, of "Hives, Bees, and their Produce," of far greater magnitude than was ever gathered together in Great Britain before. Such competitive exhibitions surpass everything else as a means of improving all sciences, and the present advanced state of agriculture and horticulture, is mainly attributable to them. The Apiarian Exhibition formed no exception, an immense impetus was given to Bee-keeping, and multitudes of persons vowed to keep Bees, pleased and astonished at sight of the wonderful supers of honey, and the interesting practical demonstrations of Bee management that were shown, where the Bees, thanks to the skill, coolness, and courage of the manipulators, seemed to set aside all will of their own, obedient only to that of their masters. The Association hopes to make these exhibitions annual, and to further by a variety of other means the advancement of Bee-keeping, both as natural science, and particularly as a means of bettering the condition of

cottagers, and the agricultural labouring classes, as well as the advocacy of humanity to the industrious labourer, the Honey Bee. The expenses naturally attendant on these efforts to do good although not heavy (no officers being paid), can only be met by the addition of members to the ranks of the Association, and the hearty co-operation of all Bee-keepers. Let no one, therefore, stand aloof, but contribute his mite both of money and goodwill to aid the progression of Bee-keeping.

Many persons reading my account of how the Bees are to be used will naturally feel surprised, and, perhaps, doubt that they themselves could ever arrive at a point that would enable them to remove all the Bees from a hive, shovel them up or drive them about wherever they desire them to go, and will, perhaps, think they might as well be told to enter a lions' den and put the noble beasts through their performances after seeing the keeper do so. To those unaccustomed to Bees the doubt is reasonable; but there is no secret or charlatanism in the matter. A certain amount of courage must be present with coolness and quietness; the rest is easy if my instructions are followed. During the practical exposition of Apiarian manipulations at the Crystal Palace, more than one lady was courageously present in the manipulating room, by their own choice, without receiving any injury, although thousands of Bees, driven from their hives, were crawling and flying all round, while the spectators behind a glass screen gazed with astonishment both at the Bees and the ladies. The facility of handling Bees is not of modern origin. A century ago, a Bee-keeper, named Daniel Wildman, who was domiciled in Holborn, astonished London by his performances with these insects. He

had an exhibition at Islington, the records of which, although we must take them "with a grain of salt," show that he had a considerable acquaintance with the fears and dispositions of Bees. It is said he could cause a swarm to settle almost instantaneously where he pleased, even on his head, remove them to his hand, a window, table, &c., at pleasure. This seemed wonderful; but the solution was simply possession of the Queen —where she went, there went the Bees! To keep Bees in a merciful and rational manner it is by no means necessary to undertake all the operations I describe, or even adopt frame hives. If the rudest form of hive, the straw skep, be maintained, it is yet not at all necessary to destroy the Bees to get their honey. Read and master the one chapter on "Driving," and the Bee-keeper can rifle their stores, yet preserve their lives and strengthen his stocks for next year, so that they will be able to do double work in reward for their master's humanity.

> "Leave them happy in their copious store,
> A part they'll give; and why desire ye more?
> And must ye kill? Mistaken thought—ah!—shame,
> No more involve them in sulphurous flame."

Cottagers can, if they desire it, gradually master all other manipulations in time. Gentlemen who are already adepts will willingly give all the help in their power. The cottagers of Scotland far exceed the English in the ability they display in Bee-keeping. The country gentlemen desirous of helping his poorer neighbours, cannot do a better thing than furnish pattern improved hives and show how they are to be managed, supplemented, if need be, by a swarm of Bees which may be repaid out of its increase.

When an Apiarian can handle his Bees with impunity, their study becomes a fascinating pursuit, their doings are so truly wonderful — the temptation to inhale the fresh air and watch the Bees becomes too strong to be resisted, a man's mind and knowledge expand from the wonders he beholds. New friends are made, ideas are interchanged, inventive faculties are set in motion to fashion some aid for the Bees or their master, and many are the delights that spring from the contemplation of the busy throng. And then the children! what delight they exhibit to see the busy Workers set out or return from their labours in the fields; what lessons in mercy do they receive when they pick up the poor little Bees who, returning to their hives, fall chilled to the ground. Children are easily taught not to hurt the Bees, and they then discover the Bees will not hurt them. My own little ones, two or three years old, will stand before the hives peering into the entrance quite unmolested, and they will at my bidding allow the Bees to crawl over their hands— knowing they will receive no injury. Fear for the children need never deter any one from keeping Bees.

Amongst all naturalists there is a kind of Freemasonry which makes welcome the visit of any person with similar tastes; and should the Bee-keeper, who is desirous of learning more, find himself in the neighbourhood of a scientific Apiarian, let me counsel him to pay the latter a visit; he will, I am sure, be truly welcome to a sight of the apiary and a friendly chat, which must be barren indeed if both parties do not part wiser men. Many years ago, as an entomologist, I collected insects of another order. Whenever I found myself in a strange locality my first inquiry was for

others of a similar taste on whom I made a point of calling—need I say I never met with a rebuff, but, on the contrary, made many pleasant friends.

One of the principal writers on the Bee was Francis Huber, an eminent naturalist of the last and present century. *He was totally blind;* yet even this great deprivation did not hinder him from becoming the greatest and most accurate observer of Bees that had ever then lived. His observations were made with the eyes and assistance of his servant, Francis Burnens, who, although a peasant, was a man of great talent, possessing indefatigable energy and enthusiasm; Huber was also assisted by his wife. His observations and deductions made, although many of them have since been proved incorrect, gave to the world a wonderful store of facts hitherto unsuspected, and laid the foundation for the labours of many naturalists of later times. His "leaf hive" was the first frame hive; it was very valuable for observation purposes, and is yet often used, although not so convenient as some newer inventions.

Wise little creatures are Bees! for they seem to be warned of the approach of bad weather by some particular instinct; it sometimes happens when multitudes are abroad very busy, they will on a sudden cease from their work; not a single one stirs out, and those that were away hurry home in such crowds that the entrance of the hive is too small to admit them. On such an occasion, look to the sky and you will, probably, discover some of those black clouds that denote impending rain. Whether the Bees see the clouds gathering, as some imagine, or whether they feel some other effects of the change on their bodies, is not yet determined;

but it is asserted that no Bee is ever caught in a sudden shower, unless it be at a very great distance from the hive, or injured by accident. Searching for wild Honey Bees in England would, I am afraid, be an unprofitable task. In many country districts Bees are known to be located in certain hollow trees or roofs of houses; but the proprietors, although, perhaps, they would be glad to get rid of the Bees, would not so readily allow their house to be dismantled or their tree to be cut down. In America, however, they are not so particular, and many men make a living "Bee-hunting;" others who do not follow it as a calling do not fail to take advantage of the lucky find when it occurs.

The time that Bees will inhabit some stations is wonderful. Thorley tells us that a swarm took possession of a spot under the leads of Ludovicus Vives, in Oxford, where they continued one hundred and ten years, from 1520 to 1630.

The way Bees are tracked is simple in the extreme.

> "He fears no bailiff's wrath, no baron's blame;
> His is untaxed and undisputed game."—CRABBE.

The following I extract from *King's Bee-keepers' Text Book*:—

"When Bees are at work upon flowers, a 'line' "may be started by taking a piece of board upon "which is a small piece of comb filled with diluted "honey. You will also need a glass tumbler and "a piece of brown paper, or dark coloured cloth. "Having found a Bee upon a flower, place over it the "tumbler and leave it inverted upon the cloth till the "Bee rises to the top. Wait till it has done buzzing "(that it may not get besmeared with honey), then "carefully raise the tumbler and place over it the

"honey on the plate, wrapping the cloth around the "upper part of the tumbler to darken it. The Bee "will descend towards the light when, coming in "contact with the honey, it will commence loading "up. Gently remove the tumbler while the Bee is at "work, and, stepping a few feet, place your eye near "the ground. With the clear sky for a background "it is easy to keep sight of the Bee as it rises, "describing several circles at first, then striking 'a "Bee line' for home. It soon returns with many "others. When a number of Bees have got to work, "cover them with the tumbler and, moving them "along the line towards where the hive is supposed to "be, again liberate them. Care must be taken not "to go too far, or else the Bees may not return. If "the place is now supposed to be near, mark the line "of Bees by letting an assistant, stick in range a few "stakes. Again cover the Bees and carry them a few "rods right or left of the line in order to get a cross "line.

"Mark this also with stakes, then lengthen both "lines by sticking more stakes, and the hive will be "found where the lines meet."

An old book, *Letters from an American Farmer*, contains the following graphic description of Bee-hunting :—

"After I have done sowing, by way of recreation I "prepare for a week's jaunt in the woods, not to hurt "either the deer or the bears, as my neighbours do, "but to catch the more harmless Bees. I cannot boast "that this chase is so noble or so famous among men, "but I find it less fatiguing and fully as profitable; and "the last consideration is the only one that moves me.

"I take with me my dog as a companion, for he is "useless as to this game; my gun, for no one ought to "enter the woods without one; my blanket, some pro- "visions, some wax vermilion, honey, and a small "pocket-compass. With these implements I proceed "to such woods as are at considerable distance from "any settlements. I carefully examine whether they "abound with large trees; if so, I make a small fire "on some flat stones in a convenient place. On the "fire I put some wax; close by this fire, on another "stone, I drop honey in distinct drops, which I "surround with small quantities of vermilion laid on "the stone, and then I retire carefully to watch whether "any Bees appear. If there are any in that neigh- "bourhood, I rest assured that the smell of the burnt "wax will, unavoidably, attract them. They will soon "find out the honey, for they are fond of preying on "that which is not their own, and in their approach "they will necessarily tinge themselves with some "particles of vermilion which will adhere long to their "bodies. I next fix my compass to find out their "course, which they keep invariably straight, when "they are returning home loaded. By the assistance of "my watch, I observe how long those are returning "which are marked with vermilion; thus possessed of "the course, and in some measure with the distance "which I can easily guess at, I follow the first, and "seldom fail of coming to the tree where the Bees are "lodged. I then mark it, and thus with patience I "have found out sometimes eleven swarms in a season; "and it is incredible what a quantity of honey these "trees will sometimes afford; it entirely depends on "the size of the hollow, as the Bees never rest or

"swarm till it is filled—for, like men, it is only the "want of room that induces them to quit the maternal "hive. The first Bees I ever procured were thus found "in the woods by mere accident, for at that time I had "no kind of skill in this method of tracing them. "The body of the tree being perfectly sound, they had "lodged themselves in the hollow of one of its prin-"cipal limbs, which I carefully sawed off, and with a "good deal of labour and industry brought it home, "where I fixed it up in the same position in which I "found it growing. This was in April. I had five "swarms that year, and they have been ever since very "prosperous. This business generally takes up a week "of my time every autumn, and to me it is a week "of solitary ease and relaxation."

Bee-keeping is more or less carried on in all civilized and many semi-civilized countries; from the cold inhospitable region of Siberia, to the sultry shores of Africa, we may find Bee-hives often in vast numbers. Spain teems with them; in the rural districts they are everywhere found, as also in Russia where, in the province of Yekarterinoslaw, there are nearly four hives to every human being.

In former times, Poland was celebrated for its Bee culture, and is still so now to some extent in the province of Lublin, it having everywhere else fallen into decay. The reason why Bee-keeping is so industriously carried on in Russia is twofold. Firstly, because the peasants use honey instead of sugar; and secondly, because wax tapers to the value of 1,200,000 rubles (nearly £182,500) are required for the churches. Buschen states the quantity of honey annually produced in European Russia to be 600,000 to 700,000

pounds (9,643 to 11,250 tons), and a proportionate quantity of wax.

In the United States, apiculture is carried on largely, both as a distinct trade and adjunct to other farming, with a great amount of scientific attention. Many of our most valuable apicultural improvements and inventions have had their origin there, and in no other country would the old straw skep and death-and-brimstone system meet with greater contempt.

California may, probably, boast of one of the largest and certainly the most productive apiary in the world; and its owner, Mr. Harbison, undoubtedly occupies the position of one of the foremost Bee-masters, at any rate as far as money-making from the business is concerned. This gentleman has now 2,000 colonies, which last year produced 150,000 pounds or 67 tons of surplus honey of very excellent quality, netting by sales the nice little sum of 30,000 dollars! The labour in attending to all these Bees is done by eight young men who are apprentices to the business; and some of them are very expert in apiarian manipulations.

Germany, too, boasts of many famous Bee-keepers, and in comparison with that Empire, Great Britain is far behind. Here, where one hive is kept, we might have a thousand; where one pound of honey is gathered, a ton is wasted. Vast quantities of honey are annually imported from France and the West Indies which should be supplied by our own rural labouring population who, in addition, might, as I have above stated they do in Russia, use it in lieu of sugar. According to the best authorities, it is impossible to overstock a neighbourhood with Bees—at least it never has been done—and, therefore, we may conclude there is no

danger here. In Germany, many apiaries contain in close proximity 200 to 300 hives. Ehrenfels had 1,000 in three separate establishments, but sufficiently near together that he could visit them all in half an hour's ride. In Russia and Hungary, apiaries numbering from 2,000 to 3,000 hives are not unfrequent, and as many as 4,000 are often congregated together at one point on the heaths of Germany. It is calculated that in Hanover there are 141 hives to each square mile and a German writer alleges that the Bees of Lunenberg pay all the taxes assessed on their proprietors, and leave a surplus besides—this in a district so barren that it has been called the Arabia Petrea of Germany.

In former times, the Island of Corsica, comprising 3,790 square miles, paid to Rome an annual tribute of 200,000 pounds of wax, which presupposes a production of two to three million pounds of honey; and East Friesland, a province of Holland, maintains at the present day an average of 2,000 hives per square mile. These statistics could be indefinitely increased, and they show that, comparatively, Great Britain is bare of Bees. I question if we have *one* colony to a square mile.

Oettl says: "When a large flock of sheep is grazing "on a limited area, there may soon be a deficiency of "pasturage. But this cannot be the case with Bees, as "a good honey district cannot be readily overstocked by "them. To-day, when the air is moist and warm, the "plants may yield a superabundance of nectar; while "to-morrow, being cold and wet, there may be a total "want of it. When there is sufficient heat and moisture, "the saccharine juices of plants will readily fill the nec-

"taries, and be as quickly replenished when carried off "by the Bees. Every cold night checks the flow of "honey, and every clear warm day reopens the fountain. "*The flowers expanded to-day, must be visited while open, "for if left to wither, their stores are lost.* Bees cannot "collect to-morrow what is left ungathered to-day."

How long shall it continue to be said that we thus allow God's gifts to be wasted before our eyes? This has become an age of utilization. See the multitude of formerly "waste" products that are now made useful; and yet, throughout the length and breadth of this flowery land:

> "Full many a flower is born to blush unseen,
> And waste its fragrance on the desert air."—GRAY.

I appeal, therefore, to the clergymen, the country gentlemen, and all those who, by their rank and position, are looked up to, and have influence with the labouring classes, and would say to them: Encourage by every means in your power the spread and growth of Bee-keeping. Teach by the force of example what satisfactory results may be obtained by improved hives, and a more sensible and humane policy towards our interesting and industrious little fellow labourers; let it be seen that the produce of a dozen hives, with little labour, and scarcely any outlay, will suffice to pay the rent or find shoes for the little ones; and in the course of a few years, we shall find no cottage without its hive or hives, and the old barbarous system of Bee slaughter will be quite a thing of the past.

HIVES.

"And behold there was a swarm of Bees and honey in the carcass of the Lion."—JUDGES, Chap. XIV., v. 8.

ONE of the primary considerations to the Bee-keeper is a proper selection of hives; and in this chapter it is my purpose to give an impartial description of the most useful patterns with which I am acquainted. It does not always follow that the most perfect hive is suitable to all; in the first place, cost is oftimes a great consideration. One person will desire to study the natural history of the Bee, and use his apiary very much for scientific investigation, without regard to pecuniary profit; another will look to the latter point alone; while a third will, perhaps, for want of leisure, or of education, only be able to manage the hive which gives the least possible trouble, content to sacrifice a large portion of profit. Hives naturally divide themselves into two great classes, viz.: straw skeps, where the combs are immoveable, and wooden frame hives, where the combs can be removed at will, and the whole internal economy of the hive investigated by the Bee-master. To the latter class of Bee-dwellings we are indebted for a great multitude of facts, which have in modern times come to light in apiarian science, as well as many physiological discoveries, of great interest to the naturalist.

The crude idea of moveable combs is, indeed, of very ancient date, having been adopted by the Greeks in the days of their prosperity, but having been of a very rude character, appear to have fallen into disuse; the plan adopted was to induce the Bees to start their combs from moveable bars, but as they were generally attached to the sides of the hives, they required cutting away before removal, which in some measure prevented constant observation from the natural objection of the Bees to have their works destroyed. It was reserved for our own times to make a great stride in management by the invention of the moveable frames (in lieu of bars), suspended free in the hives, and removeable at pleasure without greatly disturbing the Bees. The credit of this device is attributable to the Rev. L. L. Langstroth, an American Bee-keeper of great renown, and another equally celebrated German Bee-master named Dzierzon, who seem simultaneously to have hit on the same plan, and who each constructed hives on this idea about twenty-three years ago, which, with many slight modifications and improvements, form the governing principles of our most popular hives at the present day. Commencing with a description of

Straw Skeps,—The general form of which is known to all. These, although fast being superseded, are yet used, and will be for many years to come, as the common hives of the cottager. I will endeavour to point out the best varieties. Now, the straw skep, although very far from the *best* hive, is not to be despised; indeed, it is a very useful hive, and however advanced the Bee-keeper may be generally, he is not wholly without it in one pattern or the other. If a census were taken of the Bees' dwellings throughout Britain, the skeps would far

outnumber all other kinds put together. A well-made straw hive is warm and healthy for the Bees and cheap to their owner; indeed, most cottagers make their own, costing almost nil, and affording employment for a wet winter's day when other work is scarce. I like a skep, it is so nice and handy; and if its interior were not like a sealed book it should have an honoured place in my apiary; but its great disadvantage is the impossibility of investigating its interior with satisfaction.

Fig. 5.

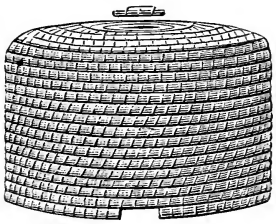


Fig. 6.

Common Cottage Straw Skep.—Two patterns are generally followed in making these hives. The one which I suppose we may call the "original," Fig. 5, a closed dome, usually with a ring at the top; the other the "improved," Fig. 6, has a flat top, with a feeding hole in the centre, which should not exceed 2 inches in diameter. This latter is incomparably the best, as it affords proper facilities for feeding the Bees, which will often save their lives; its cost is not more than from 1*s.* to 2*s.* 6*d.*, and it may be purchased in most country towns. All straw hives are much improved and their durability increased by encircling their bases with a flat wooden hoop 2 or $2\frac{1}{2}$ inches broad. The hive known as the "Pettigrew

Hive" is nothing more than a large flat-topped skep. There are three sizes, viz., 16-inch, 18-inch, and 20-inch hives; that is their width inside measure, and they are all 12 inches deep. When well filled they weigh respectively 60 pounds, 100 pounds, and 130 pounds. They are made in Ayrshire of wheaten straw, neatly and firmly built. These hives are largely used in the North of England and in Scotland; and Mr. Pettigrew quotes instances where the Bees have in them gathered as much as 164 pounds gross weight of contents. When using such large skeps the Bees cannot be expected to store any honey in supers, and in a great measure the quality of the honey is sacrificed without any adequate benefit. The combs in the main hive must of necessity become soiled from the labours of the immense population; while, had half the store been gathered in a super, this half would be worth as much as double the quantity from the breeding hive. To those who determine on the use of straw skeps I would recommend the pattern of Fig. 6, of about 14 inches in diameter by 8 deep, inside measure. These will be found a very manageable size, admitting the use of a super when required. For exceptionally good localities larger hives may be used. It is highly important that the material of which they are made should be good sound straw, and the bands of adequate thickness; for on this, be it remembered, depends in a great measure the well-doing of the stock. Each hive will require a sound wooden floor board—if $1\frac{1}{2}$ or 2 inches thick, so much the better. In country districts these are well and economically cut out of the boll of a felled tree. It should be at least 1 inch greater diameter than the hive, and have a projecting front for the Bees

to alight on (see the floor board on Fig. 10), which should, with the remainder of the margin of the board, be bevelled off for the rain to run off. However well the skep may be made, it would be simply folly to expose them to the weather without protection from the rain, and many plans may be adopted to guard against this. A very rural way is to make a conical straw hackle, Fig. 7, fitting over the hive, and throwing off the water like the thatch of a barn. Another way is to cover the hive with an inverted flat milk pan, such as is used in dairies to set the milk in. It matters little what is used so that the desired result be obtained, for it must be borne in mind that a dry hive in winter is one of the first essentials for prosperity. The straw hackle, Fig. 7, can be made without difficulty, thus: The straw having been well soaked, as for thatching, is securely tied with basket-maker's twigs or tarred string. Hoops are then fastened within at K, L and M, N. The hackles are then fitted over and adapted to the form of the hives, then left to dry, stiffen, and set. A wooden peg or two passed through the hackle above the hoop into the hive side will prevent the wind disturbing it.

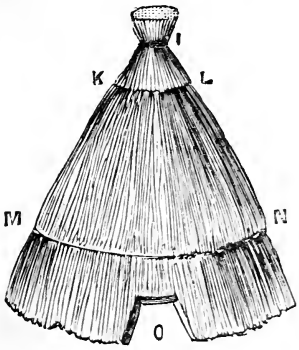


Fig. 7.

The following suggestions, published in *The Country*, by Mr. Cheshire for skep covers will be found both useful and ingenious:—

"Double back upon itself a flour or manure sack, as "you would a stocking before putting it on, and draw "this down over the skep until the doubled edge is "round the lower part of the hive, just above the "flight hole, which should be kept open by a little "bridge of wood, zinc, or tin. A cord may now be "tied round the sack at the lower part, while shavings, "sawdust, or straw should be filled in between the "parts of the sack, as it were between the foot and leg "of the stocking, until the hive crown is well covered, "for here it is that the loss of heat is the greatest. "The sack's mouth being tied, the operation is com- "plete, and we may make the hive sufficiently secure "to winter in the open by putting over it an inverted "milk pan, if of sufficient size, or, better, the cover, "Fig. 9, to be presently described. I could wish all "skeps were too large to be covered by American "cheese boxes; but this not being the fact, I will "explain how these covers, which may be obtained for "the sum of 3*d.*, may be made into capital raintight "protectors, good for ten years' wear. The lid of the "box, placed on four inverted flower-pots, or some bricks, "will make an excellent bottom board, while the box "proper forms the case for the hive itself. Before being "used, the bottom of it, which will be its top as a hive "case, should be painted well over with hot pitch, "which should be made to cover 1 or 2 inches "down the side. A sheet of newspaper, or canvas if "preferred, should now be evenly spread over the cold "pitch, when, by the application of a hot flat iron, used "after the manner of the laundress, the pitch is re- "melted, well incorporated both with the wood and the "paper, all cracks are closed, and the cover made

"absolutely rainproof. The box may now be placed "over the hive, which should be previously furnished "with sufficient hay, straw, sacking, or such like "material, to fill up any spaces. A capital cover may "be made of roofing-felt, which is sold for 8*d.* the "yard run, and is 2ft. 8in. wide. It should be cut as "shown, in Fig. 8. "Make a notch in a "lath, 17in. from its "end, at one inch "from which bore a "hole with a brad-"awl, which stick "16in. from the end "of the felt at B, "and equally distant "—that is, 16in. from each edge. With chalk in the "notch in the lath run round the three-quarter circle, "A, C, E. Now place the awl at A, and describe the "three-quarter circle F, D, B. Cut out the two covers "through F, A, B, E. Draw their straight edges "together, until one edge touches the dotted line. "Tack these two edges together into a thin lath, and "the cover is in form. The waste pieces of felt, which "will be very small, will suffice for four straps, to be "fastened underneath by clenched nails, and which "may be tied to the "hive by a string passing "round it. This will "effectually prevent the "cover being blown "away in the stiffest "gales. Fig. 9 shows "the cover complete;

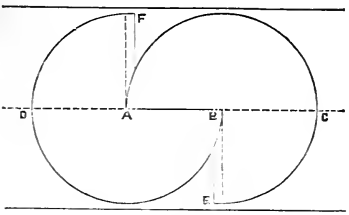


Fig. 8.

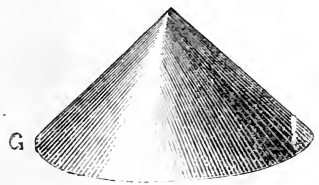


Fig. 9.

"it will be 24in. in diameter, G, H, and will afford, in "consequence of its greater size, far better protection "than a milk pan, while it costs only $5\frac{1}{2}d$. Coated "with tar, and afterwards sprinkled with hot sand, "this cover will last many years. The same form in "zinc would be more sightly, but it would cost about "1*s*. 6*d*. for material."

Neighbour's Improved Cottage Hive.—This has been a popular hive for many years, and is pretty and interesting to those who are satisfied with a transitory view of their industrious labourers. It consists of a circular straw lower compartment, or main body of the hive, having three windows with outside shutters. A thermometer is fixed across the centre window, so that the Bees cannot work between it and the glass, and thus intercept the view of the graduated scale. The stock hive, encircled with a hoop, rests on a stout floor board fashioned with a projecting landing-place for the Bees. The top is also of wood, having three or more circular openings of about 3 inches in diameter, to receive as many bell-glasses, having fixed on their tops internally a tube of perforated zinc for ventilation, to which guide combs may be fastened and which also forms a convenient support for the Bees when commencing their labours; over all is fitted a cover of straw (also

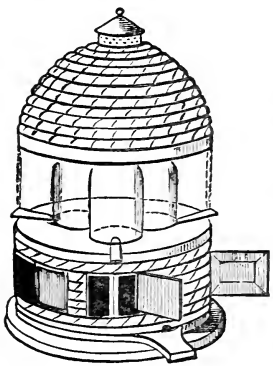


Fig. 10.

hoop bound) closely fitting the top of the stock hive, and permitting removal with great facility to allow inspection of operations; this straw cover is surmounted by a ventilator forming a neat finish. The price of this, 35*s*., is, however, a bar to its general use, more especially as, unlike most hives of an equal cost, the combs are immoveable.

THE CHESHIRE CRYSTAL PALACE PRIZE HIVE.—

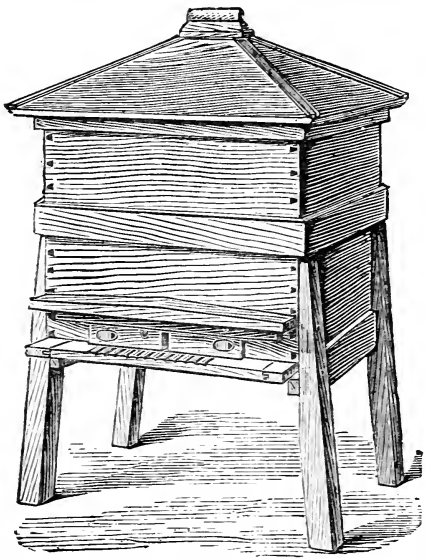


Fig. 11.

The Judges at the Great Apiarian Exhibition, after having examined the many Hives shown, awarded the palm to Mr. Cheshire for this hive; and I may say I

quite concur in their judgment, and those who can afford its purchase will find it easy to work with, as well as giving the minimum of disturbance to the Bees, and affording every facility to investigate all parts. I extract the following description from the pages of *The Country*:—

"The hive consists of two main portions; the super "cover, the upper half of what may be denominated "the body; and the hive proper, the lower portion in "which breeding is carried on, and where the Bees "pass the winter. Over the entrance is a porch, its roof "consisting of a stout piece of pine, about 3in. wide, "and running completely along the hive face. This is "chamfered off towards the end, the more effectually "to carry away drip, and has a channel near its front "edge, which acts as a gutter, by which the rain is "conveyed to its ends. This gutter is shown in the "cross section, Fig. 12 at E. The bottom board of the "hive projects $2\frac{1}{2}$in. along the front, so as to form a "very convenient alighting board; 10in. of the central "part of this is grooved as seen in the figure, so "that should it be reached by driving rain the convex "parts remain free of water, affording the Bees a dry "passage-way to the interior. The flight hole is also "10in. in length, and is formed by cutting from the "hive-wall a piece a full $\frac{1}{4}$in. deep (see G, Fig. 12). F, "Fig. 12, is screwed on beneath the porch roof to give it "additional stability and also to provide the groove "for two sliding shutters (shown in Fig. 11), by which "the entrance way may be regulated as occasion may "require. Upon the upper part of the ends of these "are two small studs preventing the shutters from "meeting, so that the entrance can only be reduced to

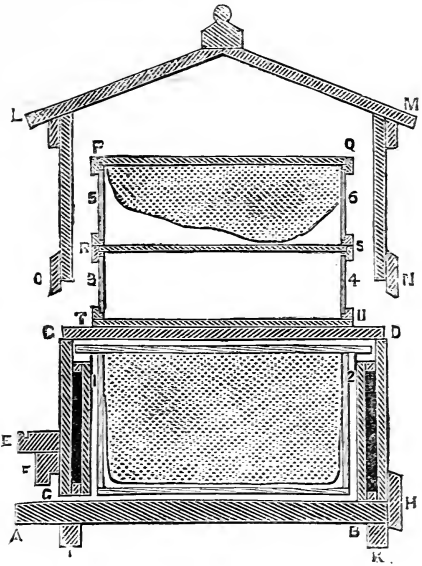


Fig. 12.

"about half an inch. This arrangement prevents the "accidental closing of the hive mouth to the destruc- "tion of the colony, while it admits of its (*i.e.* the "mouth's) immediate lessening in the event of robbing, "or for the purpose of wintering. Should, however, "the absolute stopping of the entrance way be desired, "the doors may be removed, and put in the right on "the left, and the left on the right, when they will "meet, as their studs will be on their outer instead "of their proximate ends.

"In the height of the honey harvest, or near swarm-

"ing time, the full length of the mouth may be obtained "by simply sliding the shutters to the end of the "alighting board; while during the summer the fanners "will be enabled to pursue their labours in the shade. "The bottom board is so contrived that it can be "removed without disturbing the Bees, as it slides upon "two runners seen beneath it in Fig. 11. Blocks I and "K, Fig. 12, fitted in between these runners and bottom "board press it against the hive body and hold it in "position. The legs are fastened to the hive proper, so "that it carries its own stand. This plan is, in some "respects, convenient. During the winter the board "may be easily cleaned, and returned without risk of "disturbing the cluster; but the fixed legs present to "the beginner some difficulty in introducing the swarm. "So that for the general community of Bee-keepers I "am not sure that the independent stand is not to be "preferred. Either form can be supplied as desired. "When the bottom board is slipped into position it is "stopped by a back piece, H, Fig. 12. The super cover, "the upper part of Fig. 11, or L, M, N, O, Fig. 12, is "hinged, and so contrived by the aid of a chain that "it can only open until its lines, horizontal when *in* "*situ*, become perpendicular, and *vice versa*. The "advantage this supplies beyond the ordinary loose "case is considerable. It is sometimes inconvenient to "find suitable standing for the latter during manipula- "tion, while this arrangement provides the Bee-master "with a table, often of great service when the hive is "open, upon which he can place his smoker, syrup, "knife, &c., during his operations. It, moreover, carries "within it a slate with an attached pencil, so that "immediate entry may be made of any noteworthy

"point. These jottings, compiled and studied, form no "inconsiderable means of increasing the proprietor's "experience. The other points of the exterior demand "little in the way of explanation. The legs splay, so "as to increase the base and give more secure standing, "while the roof, with its ample eaves, precludes the "possibility of the entrance of rain in any weather.

"The walls of the hive are double, as may be seen "by reference to Fig. 12, and have between them a space "containing dead air, shown by the black broad lines. "The sides are kept at their proper relative distances "by blocks running above and below the air space. As "heat is conducted by air with extreme slowness, these "means prevent the escape of that generated by the "Bees during rigorous weather, while they also exclude "the ardour of the sun's rays during summer.

"The dummy (*h, i*, Fig. 13), which usually hangs "next the hive side, and gives play to the combs by "its removal, is simply a double board the same size as "a frame, and has the grain of its respective thin halves "running in reverse directions to prevent warping or "breaking.

"In order to give room for the ears of the frames, "the inner skin, front and back, is made an inch "shallower than the outer one. Standing 3-8ths of "an inch above the former are two strips of zinc (1 and "2, Fig. 12), each about an inch wide and which serve "to carry the frames so that they cannot be propolised, "while they—*i.e.*, the frames—can be slidden back-"wards and forwards with the greatest ease during "manipulation. The top bar of the frame is 3-8ths "thick, so that the space between the top bar and "the cover is ¼in. The depth of the hive (D, H,

"Fig. 12) is $8\frac{3}{4}$in., the width within between 1 and 2 "$14\frac{1}{2}$in., the frames being exactly the same in size "as those known as Woodbury's. The length (C, D, "Fig. 12) will vary with the number of frames used, "but 11 seems to give the hive the correct capacity.

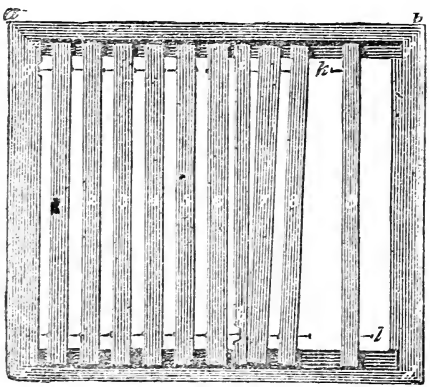


Fig. 13.

"Fig. 13 shows the arrangement of the frames, which "are kept at their correct and relative distances by "means of small nails known amongst carpenters as "panel pins. Combs 1 to 6 are shown *in situ*, and by "having the dummy as in the figure, a small swarm, "instead of weakening itself by excessive distribution, "would be cosily confined to about half the hive; and "in some cases it might be an economy of heat, and in "other ways advantageous to still further reduce their "working space. It is here worthy of remark that "removing the dummy from the end of the hive "beyond frame 11, where it would usually remain, and

"placing it in any part does not prevent the eleven "frames being accommodated as before, for if the "dummy stands as in the figure outside No. 6, the "frame beyond it—*i.e.*, No. 7—will touch the dummy "at one of its ends, and so give space for the full "length of the distance pin of the last frame.

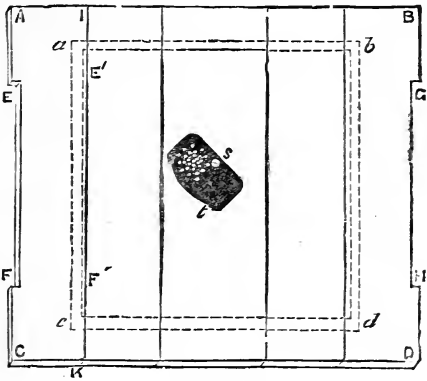


Fig. 14.

"Fig. 14 represents the crown board, the edge of "which is seen at C, D (Fig. 12). This consists of "five strips or slats, clamped at their ends to prevent "warping; they are each $17\frac{1}{2}$ inches long.

"The width of the central strip is 5 inches, while "that of the others is $3\frac{3}{4}$ inches. The central one "is pierced with a hole $1\frac{1}{2}$ inches in diameter, and "over this is placed a feeding stage. At E, F and G, H, "the top board is cut away $\frac{1}{4}$ inch in width and 10 "inches in length. Notwithstanding the removal of "these parts, the board completely covers the hive "top, but if the outside slat (A, I, C, K) be made

"to change places with the one next it, E, F will occupy "the position E, F, and will form a long hole or slat, "which will give the Bees ingress to the super, the "frame of which occupies the position of the dotted "lines, *a*, *b*, *c*, *d*. The same being done on the other side, "the Bees are freely admitted to the super, while the "Queen, the Nurses, and the pollen gatherers of the "brood nest beneath are prevented by an unbroken "ceiling from passing up into and spoiling the honey-"comb in the super."

This hive is made by Lee, of Bagshot, and sold at 23*s*. to 45*s*., according to completeness and workmanship.

Abbott's New Frame-bar Hive.—This hive, which has been lately introduced, is somewhat different to others in previous use in England. Its first and most striking feature is its peculiar shape internally, 17 inches from front to rear, and 11 inches deep. It contains 8 frames—giving much greater cubical space than the "Woodbury." This peculiarity of shape is no novelty, having been adopted and described by Mr. Quinby, of New York; and Langstroth says, "A hive from *front* to *rear*, and "moderately low and narrow, seems, on the whole, to "unite the most advantages." The frames have no bottom bar, a questionable *advantage* which was before tried and abandoned; such an arrangement is figured in *King's Bee-keepers Text Book*, as "Taylor's Frame." The intention in the present hive is to give the Bees liberty to build their combs deeper, but it is doubtful if safety in handling be not sacrificed to this; the frames also have greater tendency to warp, when, if the sides of the hive are approached too closely, the Bees fix all fast. The price of this hive is £1. 17*s*. 6*d*., and the advantages

claimed for it are, that it is free from the principal defects of other hives, having no rabbets, notches, racks, pins, or distance tacks, nor any crevices or acute angles for the Bees to waste their time in propolizing, no space between the tops of frames and adapter, and no bottom rails to frames. Its floor board is reversible, being exactly the same on both sides, and may be withdrawn and returned without disturbance. The hive is fixed on four stout legs, so needs no separate stand, and is surmounted by a super-covered roof to keep all dry, its body box being double-walled with dead air space between.

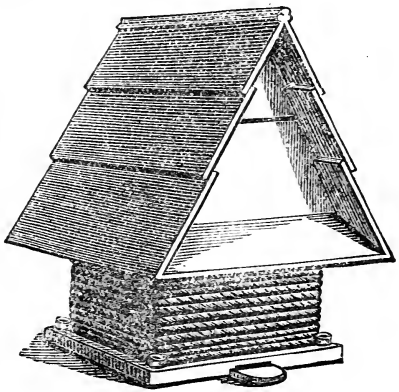


Fig. 15.

THE SHERRINGTON HIVE.—This hive is an exceedingly well-made article of straw—internally fitted much after the style of that last described—the roof is intended to allow space for supers. Those Bee-keepers who have a preference for straw over wood can, with

this, gratify their desire and yet work with frame hives. It is made by J. King, Stoke Goldington, Newport Pagnell, and sold at a very moderate price.

Observatory Hives.—By this term is understood such hives as enable the works of the Bees to be at all times in view. One of the best in use is the well-known

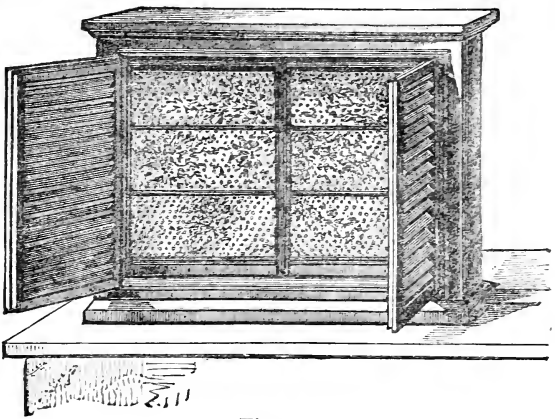


Fig. 16.

Neighbour's Woodbury Observatory Hive.—The interior of this hive is divided into six compartments which are formed by as many Woodbury frames run into notches on each perpendicular side; the width of the hive is just sufficient for the thickness of the combs, allowing the Bees free passage all over; they are kept confined by a thick glass door on each side, which in turn can be covered and the light shut off by external Venetian shutters. The framework of the hive is of mahogany, and the whole revolves on an

ingeniously constructed turn-table, giving passage to the Bees by a tunnel to the external air. It makes a handsome ornament for a drawing-room or study, placed in a window; a small aperture in the window frame will give passage to the Bees. This observatory hive has the evil of all other glass hives, the cold nature of its material, and the narrow width prevents the Bees clustering, the consequence being that no stock can be trusted to the rigours of winter in it; but its special advantage is that the framed combs can be taken from an ordinary Woodbury hive at the approach of summer and returned to their old place when summer is gone. In such a hive every Bee can be brought under observation, and when the Queen be not found on one side turn to the other and there she must be. This hive is made by Neighbour & Sons, Regent Street, London.

The Slindon Hive.—This hive, lately introduced by Mr. F. R. Jackson, of Slindon, gives great promise of becoming very useful in this class, if so much glass be not found inimical to the Bees by condensing the moisture. It has double glass back and front; the top is in four sections, three of glass and one of wood, with a quilt of Indian grass or some such material placed in winter between crown board and frames to afford ventilation. When requisite to open the hive for any purpose, only that portion of the crown need be raised where it is intended to operate. Shutters back and front are used in winter. The inventor claims that the Bees are as warm in this as in any wooden bar-frame hive, and that it affords adequate protection for housing Bees throughout the year, admitting at all times full inspection of the Bees

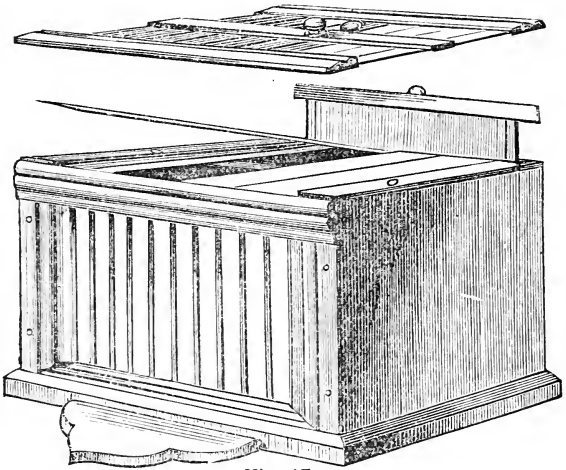


Fig. 17.

and their operations without disturbing the domestic economy of the hive by opening it. The cost is 35*s*.

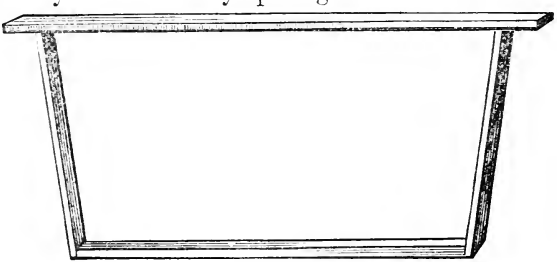


Fig. 18.

Many observatory hives of a more or less fancy description have been designed, and are generally, in their designers' opinion, *perfect;* but other people in practice yet find *much* to be desired.

Hives on the collateral principle seem to have fallen greatly into disuse; although they may still occasionally be found, their advantages are more than counterbalanced by those particular hives I have described. The varieties of hives are very numerous: more than fifty were shown at the Crystal Palace first Bee Show, and this by no means exhausted the list. Many of them, doubtless, are excellent in design, and have some desirable specialities; but there is no such thing as *the best hive* under all circumstances; either of these I have been describing will give good results if properly managed. So I would say to my numerous correspondents, who are continually asking me to recommend the *best hive*, having pointed out the advantages and disadvantages of each, I must leave the selection to their own judgment.

It must not be forgotten that the opinions here expressed are those of an individual only, in most of which some Apiarians of equal or greater experience would be found to differ. But I say again, adopt either hive, manage it with proper care, and the result will be satisfactory, although, perhaps, you may afterwards, from experience, effect an improvement. One thing, however, tending to the easy and successful management of an apiary is desirable, that is, if frame-hives are adopted, however we may vary in minutæ, is to have *all frames of the same size*, in order that they may be interchangeable with those of other hives in the apiary.

Stewarton Hive.—This is a very celebrated hive in common use about Stewarton, in Ayrshire, where, as elsewhere, it has produced most excellent results; and, when better known, will be found worthy of more general employment. In the Apiarian Exhibition at the Crystal Palace, in 1874, a magnificent display of

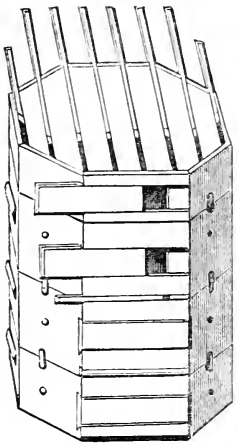


Fig. 19.

the finest white clover honey was made in the Stewarton supers; the purity, quantity, and beautiful regularity of the combs were worthy of the prize and general high commendation it obtained. This hive is octagonal, with sides strongly dovetailed together. It consists of two or three body or breeding-boxes, whose inside measure is 14 inches across from side to side, or from back to front. The height of the box, measured inside, is 6 or 7 inches. The bottom is perfectly open. The top is quite flat, and contains usually ten moveable bars or frames, placed parallel to each other in the direction from back to front. The spaces between the bars are capable of being closed by strips of wood, which slide in grooves made in the sides of the bars, and which can readily be drawn out behind when required. Windows with sliding shutters are placed in the back and front of each box, and an entrance is cut out of the front, 5 inches in width by $\frac{1}{2}$ an inch in height. In addition to the set of breeding-boxes, shallow honey-boxes, 4 inches in depth, and without an entrance in the front, but otherwise made in precisely the same manner, are used as supers. They are furnished with buttons and hooks for the purpose of securing them together.

The accompanying sectional sketch will illustrate the make of the bars or frames.

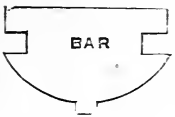


Fig. 20.

Fig. 21.

These hives are made in great perfection at Stewarton, and are marvellously cheap. Two breeding-boxes and one honey-box, without floor board, are, I believe, sold for 12*s.* 6*d.*

An eminent Apiarian, who writes under the *nom de plume* of "A Renfrewshire Bee-keeper," has contributed to the *British Bee Journal* so able an article on the Stewarton hive and system, that I cannot do better than extract it almost verbatim:—

"The general mode of manipulating the Stewarton "hive is to lash a couple of breeding-boxes together at "the weighing hooks with cord. After the bars of the "boxes have been duly furnished with comb, or em- "bossed wax sheet, run in the sliding door of the "upper, and withdraw all the slides of the lower com- "partments; then close the openings with the little pegs "accompanying the boxes. With the free communica- "tion between, the *two* become, to all intents and "purposes, *one;* the Bees may then be introduced—*a* "*prime swarm, of course.* Some eight or ten days there- "after a second prime swarm, if procurable, is hived in "the third breeding-box, and at once set down close to "the earlier one, and at dusk the last named is placed "on the top of it. The lower of the two first boxes— "now the central—has its door run in, and the slides "of the lowest are removed and pegged as before. "Should the evening prove chilly, a whiff of smoke

" may be administered to both; but this is generally " considered quite unnecessary, as it is a well established " fact that no Bee leaves with a swarm till it has filled " its honey-bag, the lower now ascends with a most " confiding hum, evidently firm believers in the old " Scotch proverb, 'Plenty freens when ye hae ocht.'

" The morning light reveals usually nothing but the " surplus Queen dead on the floor board. The lowest box " is then removed, and the entrance of the second again " opened. Should any Bees be clustering in the lowest, " the removal can be postponed till the middle of the day, " when the Workers will be more abroad.

" The object of removing the third box, is to restrict " the room, so that the combined swarms may all the " sooner complete comb building, and, packing to the " glass, be thankful to press up into the super which has " been placed thereon, fitted with guide comb. Com- " munication between stock and super is afforded by " drawing the outer slide only on either side. Should " the weather be favourable, and honey abound, it is at " once taken to; if not, it is better to run in the slides " again, and wait for a day or two; then, under more " favourable circumstances, make a fresh trial, as it is " a curious fact that Bees often will swarm rather than " accept a super open to them, which they have " previously rejected. Supposing, which is generally the " case, the Bees have taken possession, in a very few days " white comb appears at the windows; then, and not till " then, the third breeding-box is placed as a nadir under- " neath all, its slides withdrawn and pegged as at the " union, and the doorway of the central box closed once " more.

" The colony may now be said to be fairly under

" weigh, and should favourable honey gathering weather " continue, a second honey-box may be placed on the " first, and all the slides of the first super withdrawn. " To induce the Bees all the more readily to take to the " supers, I have found it a considerable advantage to " run a strip of gummed paper round the juncture of the " stock with the super, as well as with it and succeeding " ones. Should it be taken to, or if honey be plentiful, " a second slide on either side of the top box may be " withdrawn at first, either partially or wholly. This is " a nice operation, dependent on the flow of honey; and " the Bee-master must exercise his own discretion, so as, " if possible, to prevent the incursions of her majesty into " the super. The plan of admitting only the honey " gatherers of the end combs to the supers, to the exclu- " sion of the Queen, the Nurses, and the pollen collectors " of the centre, is a most ingenious, original, and, indeed, " one of the most valuable features of the Stewarton " system. A third and other supers may still be called " for, and the additional super accommodation afforded, " always uppermost; and, in exceptional cases, even " additional breeding space, by nadiring at the bottom, " may be requisite, although a strong colony was lately " wrought with but 18 inches breeding space, while " filling seven honey-boxes, or supers, in various stages " of progress. To get Bees to take to supers at first, and " to work in them steadily through the vicissitudes of " temperature, it is indispensable that they be well " wrapped up with some warm woollen stuff. I generally " employ old crumb cloths for this purpose, four plies " thick; and need I add that the Stewarton hive being " formed of wood but 5-8ths of an inch thick, it is, of " course, requisite, and must have the protection of a

" Bee-house or shed from the direct rays of the sun; or, " better still, an outer octagon case, with a nicely bevelled " roof, and an ornamental vase on top, forms a most " picturesque adjunct of the apiary or garden.

" So soon as the lowest super is seen sealed at the " windows, the attachments between it and the stock and " second super, severed with a thin wire, it had better " be removed, the next lowest taking its place, and so on, " till the end of the season. When all are removed, and " slides reintroduced, then, as cold weather sets in, and " the lowest breeding-box vacated, it, too, is better taken " away, the slides replaced, the mouth wrapped carefully " up with paper to exclude moth and dust, and suspended " in any cool dry garret till required the next season."

The Carr Stewarton Hive.—This hive, designed by Mr. C. W. Smith, is a modification, and, in some respects, an improvement on the original "Stewarton," and is in my opinion by far the handsomest hive made, especially when worked in straw, as shown in the woodcut; it then becomes quite an ornament to the lawn or garden. It is manufactured by James Lee, of Bagshot, Berkshire.

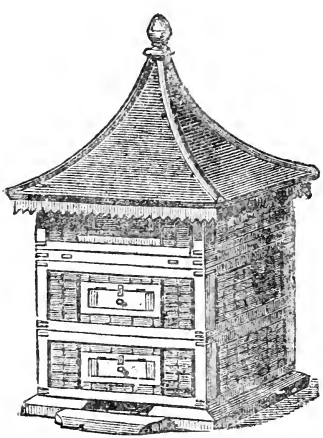


Fig. 22

Combined in it are many of the advantages of the best bar-frame hives, as well as those of the far-

famed Stewarton. A hive may consist of one, two, or three stock-boxes and a honey-box. The stock-boxes are 15 inches square, and 6 inches in depth. The honey-box is but 4 inches deep. Each stock-box is furnished with nine moveable wedge-shaped bar-frames, guides, windows front and back, &c. The honey-box contains seven wide bars for honey-combs the spaces between the bars being fitted with slides, like the octagonal Stewartons. A crown board, having slats and slides of the same gauge as those in the honey-box, is provided, but is reversible, so as to suit the advocates of a close-fitting lid, or those who prefer a ¼-inch space above the bar-frames.

The stock-boxes can be used separately or together according to the strength of swarms.

With this hive, stocks and swarms can be united, or artificial swarms made with the greatest ease; and in summer or winter every stock in the apiary may be properly aided by telescopic expansion or contraction of space, any degree of warmth needful being maintained.

Woodbury Hive.—This hive with which the late Mr. Woodbury, of Exeter, introduced the bar-frame system, was, I believe, first described by him in the *Journal of Horticulture* (to which he was a leading contributor), in 1861. Although some improvements have been made, which I will presently endeavour to describe, the term "Woodbury Hive" is still a household word

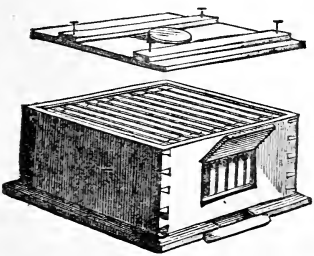


Fig. 23.

amongst Bee-keepers, and there are few of any note who have not partly or wholly adopted it at one time or another.

The following is Mr. Woodbury's own description of the hive, as it appeared in the *Journal of Horticulture*:—

"Frame hives are made of inch wood, 14½ inches "square, and 9 inches deep inside, dovetailed and put "together with paint, the ends of the dovetails being "pinned through with stout iron wire driven from the "top and bottom, and meeting in the centre. A window "7½ inches long by 4 deep affords a slight view of the "interior from the back (not the front as engraved), "but is much obstructed by the frames. The crown "board which is raised in the engraving (Fig. 23) is "keyed to prevent warping, and is secured by four long "brass screws passing through the ends of the keys. A "2-inch central hole for feeding is the only aperture, "and this is closed when not in use by a circular block "of 1¼-inch wood 5 inches in diameter. A 3-8th rabbet "is cut out of the top inner edge at the back and front, "and below this are notches 7-8ths wide by 3-8ths "deep, in which rest the ends of the frames. This "arrangement affords the Bees a free passage above "the frames, as well as below at their sides. The "annexed sketch (Fig. 24) of the interior angle of the "hive is drawn the full size, and will serve as a guide "for the arrangement of the frames.

"The slips of wood forming the frame are 7-8ths of "an inch wide, and 3-8ths of an inch thick; and the "projections at the top are 5-8ths of an inch long. "When in its place the whole forms a frame 13 inches "long by 7¼ inches high (inside measure), with a

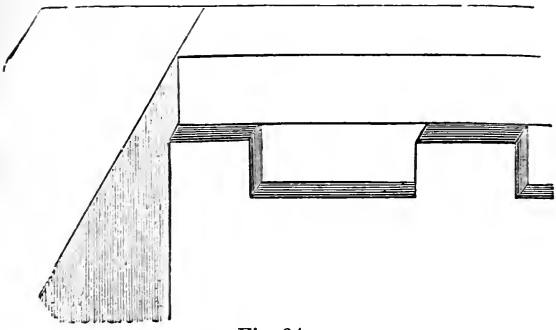


Fig. 24.

" 5-8th projection at each end, which rests in its ap-
" propriate notch in either the back or front of the hive.

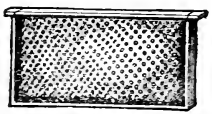


Fig. 25.

" The accompanying engraving
" (Fig. 25) represents the frame
" filled with comb, in which state
" the comb becomes so firmly
" cemented to the frame as to
" admit of its being handled with
" the greatest facility."

This, which we may call the father of our frame hives, although very good, has shown sundry inconveniences easily remedied. In the first place the crown board, although " keyed," is very liable to warp, and thus gives the Bees more air than is at all times desirable; again, when firmly propolized down by the Bees, it was difficult to move without a great shock and irritation to them, so now it is usual to make the crown board in three or four pieces (strips) and not screw them down at all. The Bees will soon make them fast, and indeed oftimes too fast; then one piece at a

time can be removed, thus exposing but a small surface of the hive's interior if desired, and a small piece of wood of course is more easily detached from the propolis adhesion than a large. It is also a very doubtful point whether so much vacant space between the top of the frames, and the crown board is an advantage, the balance of opinion is that it is *not*; and in this the Bees, who should be good judges, appear to concur, for they often try to fill it up; in which effort, if the colony be strong and space scarce, they generally succeed, giving their masters considerable trouble to clear away the comb which they have made in a wrong place. The notches forming resting places for the ends of the frames have often been found a great nuisance; the Bees, who are careful architects, will insist on firmly fixing each bar in its place; and where removal is frequently desired, considerable trouble occurs in detaching them, the small dividing blocks between the notches often breaking away, until three or four are run together. These two latter evils are now remedied either by reducing the height of the back and front of the hive to $8\frac{1}{4}$ inches, and the sides to $8\frac{5}{8}$ths, leaving the upper surfaces plain; the frames when in position will be flush with the sides and backs, this will necessitate an alteration in the shape of their tops, which may be made of the annexed form $17\frac{1}{2}$ inches long.

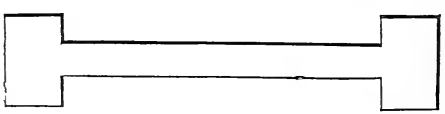


Fig. 26.

This will allow of a projection of $\frac{1}{2}$ an inch back and

front, and present a flat surface for the crown board to be placed directly on the frames, the place between the frames by the increased width given to the top bar of the frames being filled up. Another way is to reduce the height of back and front to $8\frac{1}{2}$ inches, and instead of the notches to form one plain rabbet, in which the frames are placed; but here we must have some contrivance to keep them a proper distance apart. One of the most useful is to drive a stout wire pin or French wire nail into the side of the frame, about $\frac{1}{2}$ an inch from the ends, projecting just far enough (about 17-32ths of an inch) to keep them at proper distance; two on each frame will be found sufficient, one at the top left side, the other at the bottom right side, with a similar peg in the left side of the hive *front*, and ditto right side *back*. It will be found very convenient to place between the crown board and the frames a square of Brussels carpet, or close matting, such as fish baskets are made of; this allows ventilation; and although the Bees will be sure to propolize it to the frames, it can be torn or stripped off without much disturbance; a hole may be cut in the centre to correspond with the feeding hole in the crown board. These hives are sold at various prices, from about 10*s*. to 25*s*., according to workmanship and completeness, with stand, cover, supers, &c.; but its manufacture is so simple that any man who can handle a few tools can make his own. Dovetailing is of course not absolutely necessary; if they be strongly nailed and cornered with iron angle pieces, every purpose will be answered. Those to whom expense is of importance, will find a variety of old packing cases purchaseable at most grocers, &c., for a few pence, which will provide

all the necessary material, so that serviceable frame hives need not be more costly than straw skeps with their floor boards and covers complete.

SUPERS.

Supers are receptacles intended to be placed on the top of the hive, for the Bees to store their surplus honey in, and in a great measure to prevent the necessity of swarming. Favourite supers, which may be used on hives of any shape, are bell-glasses; they may, of course, be had of any capacity, to hold from one to fifty pounds of honey. Nothing looks cleaner, or could be handsomer as a breakfast-table ornament, than a bright bell-glass, on an appropriate stand, well filled with luscious golden honey. Glasses of any fancy shape may be used; at the Manchester Exhibition of 1873, a glass model of the Crystal Palace appeared filled with eighty-five pounds of comb and honey. For frame hives, square supers—a combination of wood and glass—are very suitable, and are easily made by any handy man, and I extract a description from the *British Bee Journal* of one of the best and cheapest of this kind :—

"It has very much the appearance of the original "Woodbury super, having wooden framework with "glass panels; it is 13 inches square and 4 inches "deep, and is fitted with seven bars. Its construction "is a marvel of ingenuity. It is made almost

" entirely by means of a circular saw, and every one " of its parts is cut to a mathematical nicety, so that " they fit each other with great precision, and are all " interchangeable with the parts of other supers of the " kind. It is composed of two square frames and four " ingeniously constructed pillars, each of which is a " study in itself; one of the frames is laid upon the " table, with the rabbeted side upwards, and a pillar is " pressed on to each corner; the glass is then slid into " grooves in the pillars, and rabbets in the bottom " frame; the top frame is then pressed on to the " pillars, and the super is ready to receive the wax " bars, in fact is practically complete."

This super obtained the prize at the Crystal Palace as the best and cheapest super for general use. They are made and sold by James Lee, of Bagshot, at 5*s.* 6*d.* per pair; and hold, when filled, twenty pounds of honey each. The advantage gained by supers being made to take to pieces is that the honeycomb may be easily cut out for use. Those who make their hives can make their supers, and Mr. C. N. Abbott has given the following simple instructions how to do so:—

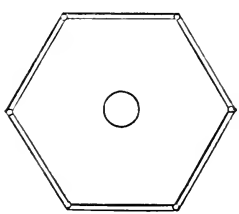


Fig. 27.

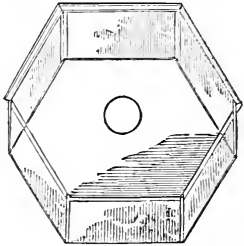


Fig. 28.

" Take two pieces of thin board of the size and

" shape determined on, and cut saw grooves half way " through about a quarter of an inch from each of " their respective sides. Fit plates of glass in one of " them, which we will call the bottom, so as to touch " at the points of intersection of the saw grooves, and " bind the whole of them together with a strip of " gummed paper round the outside of the top edges. " The glass should not be more than about 4 or " 4½ inches deep, but some boxes should be made of " much narrower dimensions, so as to be available as " ekes when the larger sizes are filled. The edges of " the glass plates should be rendered air-tight by strips " of gummed paper fixed over them, giving the super, " as shown in the engraving, the appearance of being " supported by columns at each of its angles. All " supers should be supplied with bottom boards of their " own, to be removed with the super; they need only " be made of the thinnest material. Admission from " the hive should be given by two narrow slits, " corresponding to similar slits in the crown board; " these are preferable to a central hole, through which " the Queen is apt to stray and spoil the contents of the " super by breeding therein. Whatever super is used, " care must be taken to furnish the interior with clean " decoy comb or wax sheets (to be afterwards described); " also to well wrap up the super with some warm " material, such as felt, flannel, &c., as the Bees will " mostly reject a cold unfurnished apartment."

Supers may be made of any size. A very strong stock in a favourable season will fill one holding 80 or 100 pounds, and it exhibits the skill of the Bee-master to supply the maximum size that the Bees will fill with sealed comb, as a half-filled super looks very bad.

In 1863 that veteran Bee-master, Mr. George Fox, of Kingsbridge, Devonshire, obtained from two hives glass supers of pure honeycomb, weighing respectively 109½ and 112 pounds net. These supers were made to fit over the body hive telescopic fashion, and as the Bees built downwards, so the boxes were raised, in order that the combs might be further lengthened. The same year Mr. Fox also got an octagon box containing ninety-three pounds of fine white comb from a swarm which came of so late as June 28th.

It is questionable if our Scotch neighbours, who work with the Stewarton hives, are not the wisest; they being content to obtain a number of small full boxes rather than attempt one large one, which will very likely prove a failure as to completeness. The Scotch Apiarians pack their full supers for travelling in the following manner: Clean sheets of paper are laid on the combs, and gently pushed down between each, the two edges lapping, so as to cover the edge of the combs. Then the space between the combs is firmly packed with clean soft paper cuttings, taking care to bruise no cells, and over the whole another sheet of paper laid; by this means more than thirty supers travelled 400 miles to the Crystal Palace Show without any damage whatever.

EKES AND NADIRS.

An eke is an additional space added on to a hive *below* the original. They are principally used with straw skeps, when the Bees are pressed for room; the hive is lifted up, and a ring like the rim of a sieve, in either straw or wood, placed on the floor board and the hive placed on it; the Bees will then continue their combs downwards, and will usually not swarm. If more room is still required, add another eke. When full, the ekes may be severed from the main hive by a wire, but the honeycomb in them will only be fit for run honey, as it will be contaminated with brood and Bee-bread. The straw-hivists who boast of their 160 pounds of contents in a straw hive, reckon the ekes as a part of the hive; in the rare case of this extreme weight being attained, one-third at least would be dross.

A nadir is another complete but empty hive, with open feed hole, placed below an over full one, where the Bees have been hanging out. These should be cemented together at the junction, and the Bees will then go down through the feed hole, and fill the lower hive with combs in which the Queen will breed; the upper hive may at the end of the season be removed, and the combs cut out for run honey. The only advantage, and that is a doubtful one, I can see in nadirs is, that the Bees get new combs for old ones, and swarming is prevented if undesirable. Neither ekes nor nadirs are much used in the South of England.

FEEDERS.

Much ingenuity has been exercised in designing an apparatus for feeding Bees, but they may all give place to a simple bottle, which I think most Bee-keepers of experience use; and, therefore, as the main appliance answering every purpose, I shall describe no other, simply illustrating the best manner to use that. In the first place the bottle selected should be of a squat shape, with a wide mouth; in default of better, pickle bottles answer admirably. The capacity should be one or two pints; this is filled with syrup, tied over with a double fold of net or leno, and inverted perfectly upright over the feeding hole, or without the net, covered with a piece of perforated zinc, and then used in the same manner; there being no vent, of course the liquid remains in its reservoir, unless sucked out, which the Bees are not backward in doing; a strong stock will, when active, take in and store one or two quarts in twenty-four hours, but it is not always desirable to allow them unlimited provender; to control this Mr. F. Cheshire has introduced a simple contrivance by which the supply may be regulated to the Bees, with the greatest nicety. A plate of vulcanite is fixed upon the hive board by a screw (A), to receive which a hole is first made in the vulcanite with a red-hot wire.

The central circle represents the feed hole of the

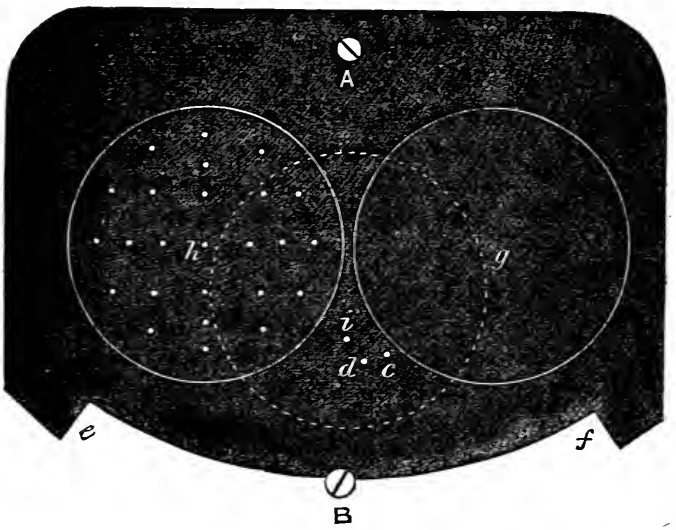


Fig. 29.

crown board, which should be situated exactly between A and B; the latter, a locksmith's screw or drawing pin, is placed so that its head laps over the edge of the plate and holds it in position, while it permits its rotation as far as the stops *e* and *f*. The plate is pierced, as per pattern in figure, by a heated knitting needle, the burrs removed by scraping, and the under side roughened by a sharp knife, so that the Bees may have foothold. If the whole has been arranged as described, and the feeding stage turned until the stop *f* touches the screw B, the circle on the right will be over the aperture in the crown board, and as this circle contains no holes, the Bees, although the bottle may be on, will get no food; but if the stage be now slowly turned back again, the hole *c* will pass over the feed hole, allowing only one Bee to regale herself at a time; a further movement, and *d* is reachable from

beneath, next the hole near the edges of the left hand circle, allowing two and then three Bees to sip at our sweets, and as the plate turns, hole after hole comes into position until the maximum is reached, when the stop at *e* arrests the revolution of the vulcanite. For liquid food the bottle and feeding stage are all that can be desired; no one at all pretending to improved Bee-keeping will suffer a hive to exist in his apiary without a hole in the crown, if not originally there, let it be cut, and a small square of wood fixed on the top with plaster of Paris will give a level stage on which to stand the bottle, of course not forgetting to cut the corresponding round hole in the wood. With the use of a perforated feeding stage, such as I have described, it is not necessary to tie over the mouth of the bottle, or to use perforated zinc, and as the stage is intended to be a fixture, the following little appliance is used to invert the full bottle without spilling the syrup: Of zinc, tin or galvanised iron, is made a small shovel, as in Fig. 30,

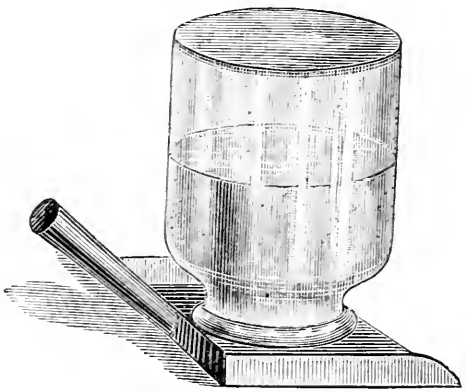


Fig. 30.

about 4 inches square, exactly after the model of an

ordinary ash shovel without the sifting holes. The bottle having been filled, the shovel (concave side down) is placed on the mouth, and the whole inverted and stood on the feeding stage; when there the shovel may be withdrawn, leaving the syrup at the disposal of the Bees. If it be desired to remove the bottle again before it is empty, all we have to do is to slide the shovel under it and invert as before. If made strong enough, this little instrument will also be found useful as a scraper to clean floor boards, supers, &c.

QUEEN CAGES.

Bees, on losing or being deprived of their Queen, will not with any certainty accept a stranger without some precaution; on the contrary, will often slay her forthwith; but it is found in practice that if a Queen be confined some twenty-four or more hours amongst the Workers the regicidal tendency abates, and the love and reverence succeed to hatred, if the Queen be in a fertile condition. An infertile Queen is not readily accepted, instinct seemingly acquainting the Bees that she is useless. The prudent Bee-master, therefore, never introduces a new Ligurian, or other Queen, without temporarily confining her. In strengthening stocks by the addition of other Bees, it is also advisable to secure the reigning Queen for a day or two as a precautionary measure against the malice of the strangers. For this purpose cages of various patterns are used.

The most simple form is that of a coarse wire gauze cup, with a $\frac{1}{4}$-inch tin margin soldered on, as Fig. 31. The Queen, with or without a few of her own Workers, is placed therein, a card slipped underneath to keep her there, and then transferred to the comb where it is desired to fix

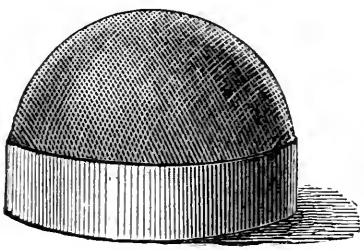


Fig. 31.

it. The card being now withdrawn, the cage is gently pressed down with a screwing motion into the comb as far as the bottom of the cell, there to remain the necessary time. It is advisable, if practicable, to tie it there, as the Bees, in their anxiety to get at the new Queen, will sometimes undermine and hoist it up, when the Queen may get out too soon, perhaps meeting an executioner. In fixing this cage, select a comb near the centre of the hive where there is some honey, so that her majesty may have food at hand. This is not absolutely essential, and in straw skeps the cage may be fixed on the bung at the top, care being taken that there is sufficient space beneath when replaced for the Bees to crowd about it.

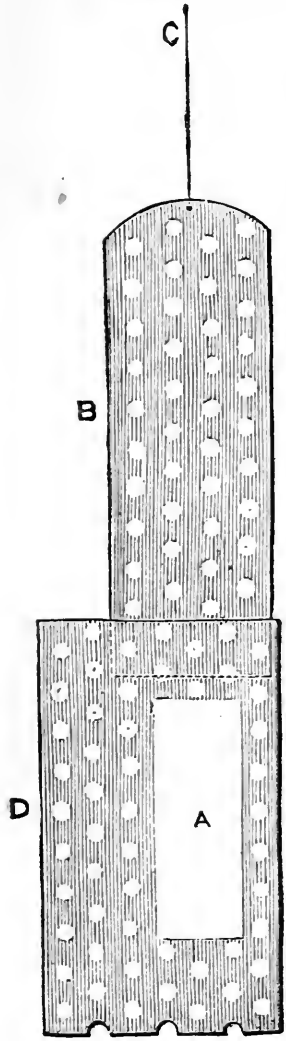


Fig. 32.

Mr. W. Carr has invented a very simple and perfect Queen cage that any mere novice can make in a few minutes. He thus describes it: "It is made of per-
" forated zinc, and measures $1\frac{3}{4}$
" inches long, 1 inch wide, and
" 1 inch deep. One side of the
" cage has an opening (A) 1 inch
" long and 3-8ths of an inch wide,
" and this is covered with a flat door (B) sliding over

"it on the inside, with a piece of wire (C) about 12 "inches long fastened to the top of the door to draw it "up; D is the open side of the cage to be pressed into "the comb. The cage is intended to be lowered down "from an opening at the top of the hive into the centre "of the brood-nest; and after the Queen has been con- "fined the necessary time, the wire is to be genlty "pulled, which will open the door, allowing the Queen "to walk out without disturbance. The cage may be "removed a day or two afterwards. Many Bee-keepers "discountenance the use of zinc on the ground that "it is injurious to the Bees. I question, however, if "this objection be well founded with ordinary care in "cleaning."

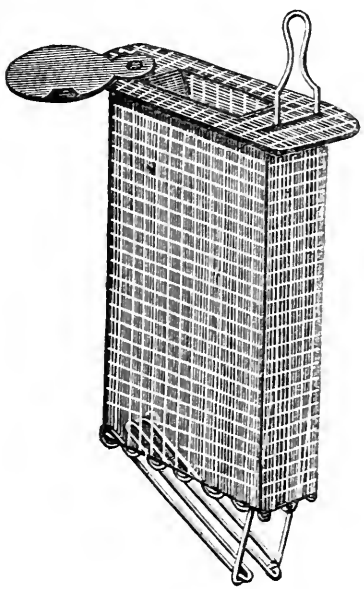


Fig. 33.

The cage invented by the well known Apiarian, "A Renfrewshire Bee-keeper," which obtained the prize at the Crystal Palace Show, is thus described by him in the *British Bee Journal*:—

"It is formed from wire "net, 2 inches deep by $1\frac{1}{4}$ "wide, and 3-8ths in thick- "ness, the top of the same "material, and projecting "1-8th part all round as a "flange, to prevent slip- "ping too far between the "combs. The door of wire "forms the bottom of the "cage, and is opened and "closed by means of a wire passing up either

"corner in front, and wrought through the top. In "some there is a circular hole on top with moveable "cover, for introducing the Queen to the cage. But to "any, saving the merest nervous novice, the space be- "tween the wires at bottom is amply sufficient for the "admittance of the royal person. Some are circular "for bung-holes in common straw skeps; but I give "the preference to those of the flat form, as they fit the "exact space between the combs of any hive. Some, for "appearance sake, are constructed of copper wire net; "and some, to prevent the rusting of the iron wire, are "japanned; but they could be made of galvanized "wire.

"*Advantages.*—From its thickness it fits the unvary- "ing width of space between the combs of all hives "alike. The flange portion on top, resting on the "frames or bars, prevents it slipping into the hive. In "hives possessing slides it is only necessary to divide a "central one, drawing the outer portion sufficiently to "receive the cage. The Queen is to be admitted to "the cage through the aperture between the central "wires at bottom, while the operator holds it inverted, "with the door open, in his left hand, the forefinger "and thumb of which cuts off her retreat sideways; "she is then shut in, and the cage suspended in the "hive. On the lapse of the requisite time (third day) "the Queen is liberated by simply pressing the top of "the wire downwards, which throws the door open, "converting it into a gangway, by which she walks "forth to meet the attendants who have been feeding "her, and are familiar with her presence; they form her "body-guard, and the risk of encasement is reduced to "the minimum. With all cages stuck into the combs,

"the Queen can only be set free after the hive has "been opened up, and the Workers, being newly and "thoroughly disturbed, are in their most irritable "mood. Should the pipe cover cage set in a bung-"hole be employed, it is requisite to draw it out and "invert it, the attendants clinging to the bottom of the "cage are transferred to the outside of the hive, and "the Queen is forced to stem the upward stream of "stranger Bees trying to force their exit. This cage "permits the Queen to be liberated without the smallest "disturbance to the hive generally. Unlike cages of "zinc, the material of this gives forth no poisonous or "deleterious exudations. The simplicity of its arrange-"ment and the inexpensiveness of the material of "which it is made, recommend its adoption by Apia-"rians generally."

Bee-keepers are not agreed as to the time necessary to keep Queens confined; some think three days, others are satisfied with one, and I have known six hours sufficient, her majesty walking out in safety after the lapse of that time. In using the wire cage of the Renfrewshire Bee-keeper, it will be perceived that it is not thought necessary to provide the Queen with any food; and I and others have been so sceptical as to doubt that Bees who are anxiously seeking an opportunity to destroy the Queen would yet feed her, but I think it has been conclusively proved that they will usually do so even when most venomously inclined. Failures now and then will occur whatever care be used, and they must not always be attributed to the cage. There are many more Queen cages in use, and, of course, there is no reason why any Bee-keeper should not make modifications to suit his own ease or fancy; but the

patterns described will illustrate the principal systems in practice. Releasing the Queen in the dark without disturbance has its advantages, but I prefer to watch her majesty's reception by her new subjects as it is often possible to prevent a regicidal attack, as is described under the head of "Ligurianizing"—there is too much trusting to chance where the door of the prison is simply opened and the prisoner left to her fate; but where the Bee-keeper is at all timid, of course the cage that may be opened from the outside is preferable. The simple cup and Mr. Carr's cages will occasionally be found useful to cover ripe Queen cells in order that the destruction of the young unhatched Queens may be prevented. When two Queens meet, a duel is certain; like two gladiateurs, each first takes a good look at her antagonist, then rush to the fight; they seize each other by legs and mouth making, with curved abdomen, every effort to insert the sting between the rings of the other's body; they wrestle thus, rolling over and over until one succeeds in giving the deadly stroke. It has been stated that if they get in such a position that both are likely to be stung together, they will separate and commence the fight anew.

> "With mighty souls in narrow bodies prest
> They challenge and encounter, breast to breast,
> So fixed on fame, unknowing how to fly,
> And ultimately bent to win or die;
> That long the dreadful combat they maintain
> 'Till one prevails (for one alone can reign)."—VIRGIL.

Last autumn, when exchanging some English Queens for Ligurians, five of the deposed sovereigns were placed in a box together—the next morning four of the unfortunate monarchs lay dead, the survivor marching triumphantly over the battle field.

BEE HOUSES.

It has long been a debatable point whether Bees do best congregated in houses or standing singly about the garden, of course, properly protected; the balance of opinion is for the latter course—mainly for two reasons. Firstly, the Bees are not so liable to rob and fight; and a most important point, the young Queens, when returning from their matrimonial excursions, are not so likely to mistake the hive from which they issued—if they do, the penalty is *death*, for the Queen of the invaded hive allows no intruders. If Bee houses or sheds are used, the hives should be far enough apart, at least 3 feet, and the hives should be dissimilar in appearance. For hives made of thin material, like the Stewarton, shelter becomes a necessity, and indeed some Bee-masters obtain very successful results from Bees kept wholly indoors, egress and ingress being given to them by a covered way leading to the open air. I think a sound rainproof open barn or other building must prove a decided advantage, securing warmth and comfort. For three or four hives very pretty little Bee houses may be constructed forming garden ornaments. The frontispiece to this work represents a "Bee Palace," a portion of the apiary of Mr. C. W. Smith, of Totteridge, Herts.

THE HONEY EXTRACTOR OR SLINGER.

This is a modern invention borrowed from the Germans, improved in America, and still further in England, but for my part I look upon it as yet in embryo as a perfect instrument, being clumsy, too large, and ugly; however, such as it is, it does good service in the manner which I will endeavour to explain. The illustration will give a good idea of the outward form of the machine, so that I will merely say that the central cylindrical vessel made of galvanized iron, 20 inches in diameter, by 24 in height, forms a fixed reservoir, with an outlet closed by a treacle valve near the bottom, intended to let out the honey when extracted. Within the reservoir is a revolving four-sided frame of wire work, wider at the top than the bottom, held in place by a central spindle working in the bottom of the can, and the frame of the top. The turning of the handle gives motion

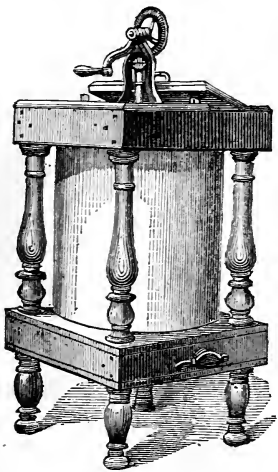


Fig. 33a.

to cog wheels, and the internal wire frame is set revolving. In some machines the cog wheels are abolished, and driving bands substituted. The machine is chiefly applicable to frame hives; full honeycombs with their frames are taken from the hive, the Bees smartly shaken or brushed off, then if the honey cells are sealed, they are carefully shaved off with a bent knife heated in hot water. The frames are placed in the wire cage of the machine; a few turns of the handle and the honey is by centrifugal force whirled from the outer side of the combs into the can; the frames are then reversed, and the second side cleared, when every uncapped cell is found drained of its honey, and may be at once returned to the Bees to refill. The machine requires a little practice before the greatest amount of skill is acquired, after which it will be found to do wonders. Experience soon teaches how to give just that amount of speed which will throw out the honey and not the brood, should any be there, and by a little contrivance, pieces of combs out of frames can be emptied. The acquisition of this appliance is a step in the right direction to get the greatest possible amount of profit from the Bees, at the smallest possible expenditure of Bee labour; and I will now show how the extractor helps us here. In the midst of honey gathering it is often found that the Bees *will not* work in the super, charm we ever so well; therefore, they hang out idle. We remedy this by taking out a few combs, emptying and returning them, when a general ardour is created to fill them again. In the midst of summer and a good honey season, Bees will sometimes gather so much that every available cell is filled. The poor Queen cannot find a place to lay her eggs, so

suffers in her health, and the contingencies of Bee life being many in the busy season, the stock absolutely dwindles, and perhaps dies subsequently, from nothing else than over prosperity. The danger of such a state of things being discovered, the extractor provides an immediate remedy as in the former case. If the emptied combs are placed in the middle of the brood nest, the Queen immediately fills them with eggs at an astonishing rate. Thus also breeding may be at any time encouraged by empty combs placed in the centre of the hive, as will be further explained. I heard a very practical Bee-keeper remark that he deprived his Bees of *all* their stores, for which he could get 1*s.* or 1*s.* 6*d.* per pound, and returned his labourers for their winter sustenance, sugar syrup, which cost him not more than 3*d.* per pound; it answered quite as well, and indeed went further. Our American cousins, from whom we get many valuable Apiarian hints, commonly manage their Bees thus: Two strong stocks are selected, which we will call A and B; from B all the Bees with their Queen are driven, making a strong new swarm; the hive, with its combs full of brood in all stages, minus its floor board, is then placed on A, which has previously had its crown board removed, and an adapter substituted. The Bees of A immediately take possession of B, hatch out all brood, while the Queen remaining in the lower hive still keeps breeding, and the immense population thus formed quickly fill the emptied combs of the upper hive with honey, which, as fast as filled, or nearly so, are emptied by the extractor, and returned; by this means a very large harvest is obtained, which has amounted to as much as 600 pounds from a single hive. Wax is a product made by

the Bees from honey, and it is said that it takes twenty pounds or more of honey to make one pound of wax; therefore every pound of comb saved for the Bees represents at least twenty pounds more honey to be harvested. Now it is quite a mistake to imagine that old combs, that is to say, up to three or four years old, are useless except to melt down. For breeding purposes they are quite as good as new; and, indeed, when the Bee-keeper handles his combs much, they are better, being tougher. I would quite as soon have my hives furnished with old combs as new. By the use of the extractor, therefore, we get all the honey and save the combs; and it will be found where a hive full of clean combs can be given to a swarm, they get a start in life for which they will amply make returns.

DRONE AND BEE TRAPS.

THESE are sometimes of considerable service in an apiary, either to capture undesirable Drones or to clear a super of Bees. Of the former kind the Drone trap made by R. Aston, Newport Salop, has been found very useful, and is thus described by its maker.

The figure represents it fixed to a Woodbury hive, but it is only necessary to alter the shape of the zinc bridge to make it fit the front of a straw skep. The trap is left on as long as is desirable or until filled; it offers no hindrance to the Worker Bees, and should the Queen stray into it, she would have to stay there until released by her owner. 1 is a sectional view of the drone trap; 2 is a perforated zinc front with apertures 3-16ths of an inch in diameter, which permits the exit of the Worker Bees only; 3 is an opening left at back to place before a Bee trap when fixed to a super, so as to catch its Drones; 4 is a glass tube down which the

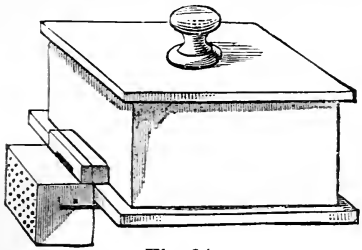


Fig. 34.

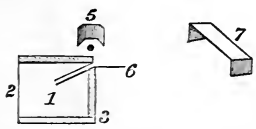


Fig. 35.

Drones march freely into the cage, but cannot find their way back again; 5 is a contrivance through which the Workers can pass as ordinarily, but it has a strip of wood along its centre which darkens the way and renders it less attractive than it otherwise would be to the Drones; 7 is the zinc bridge which may be fitted to hives of a circular shape, yet, when reversed, will be found equally serviceable for plane-fronted hives. The trap is fixed to the hive by the piece of zinc, No. 6, which is screwed to the floor board, and is held up by a support from the ground or by two light strips of wood which are thrust under the floor board and catch two nails or pins in its sides.

There are several other Drone traps in use, but the principle of all is the same, *i.e.*, to give the Workers free egress and ingress, but the Drones only the former. Workers can pass through an aperture 3-16ths of an inch in diameter; Drones cannot.

What are generally known as *Bee* traps, in contradistinction to *Drone* traps, are intended principally for clearing supers of the Bees when taken off the hive; and a very simple one which answers admirably is "The five pin Bee Trap," the invention of Mr. F. Cheshire, for which an extra prize was awarded at the Crystal Palace; this has the additional advantage that it is practically costless. On the side of a large box, bore any number of $\frac{1}{4}$-inch holes, stick

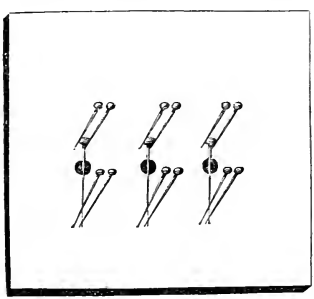


Fig. 36.

two pins nearly close together just above, and the same just under each hole, all inclining upwards, as shown in engraving. A fifth pin is then dropped across each hole and the trap is complete. Place in the box the supers from which it is desired to get rid of the Bees and shut down the lid—if the box be well made, the only light entering it will be through the holes of the trap—then tilt up the front of the box facing to the sun so as to cause the perpendicular pins to lie flat on the box, but care must be taken that the heat of the sun shining on the box is not sufficient to soften the honey-combs, which would, in that case, collapse, the Bees from the inside will make for the light, and pushing up the pin, pass out and cannot re-enter. Traps are also made on the same principle having thin plates of talc or horn hung on a wire and made to fall like the perpendicular pin described above, as in Aston's Bee Trap. In lieu of placing the supers in a box, the traps may be fitted on to any aperture in a super, taking care to darken the remainder.

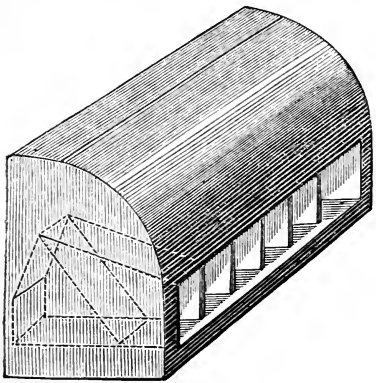


Fig. 37.

ON BEGINNING BEE-KEEPING AND THE MANAGEMENT FOR THE FIRST YEAR.

HAVING done my best to describe the Bees, the hives, and all the various ingenious appliances to assist us in obtaining the most desirable results, I will now suppose my reader is contemplating starting as a Bee-keeper. My advice is not to attempt too much at first; begin in the spring with one or two swarms; common Black Bees will do, though Ligurians are better, if the additional cost be no object. Of the former, a prime swarm should be obtainable for from 15*s.* to 20*s.*, the Ligurians about double that price.

The inexperienced in Bee-keeping will do well when starting to buy a swarm in May, or the first half of June, in preference to an old stock, unless he purchase of a person upon whom he can thoroughly depend. There is always a chance of an old stock harbouring disease, especially foul-brood, which a novice would find impossible to eradicate. A fair prime or first swarm will weigh net three and a half pounds; a very good one, five pounds. They have been known to reach eight pounds. If lighter than three and a half pounds, they would probably be casts or second swarms. These have the advantage, that the Queen is certainly young, and probably prolific, and are on

this account not to be despised if they come early in the season.

Bees are usually sold in a straw skep, which will come in very handy, even if, as we should in this age of progression determine, to work with frame hives only; if this be not the case, and the old straw skep is to be maintained, put the swarm on its stand at once, and leave it to proceed as Nature directs, not forgetting to protect it from the elements, and feed if necessary in bad weather (see "Feeding"). If the swarm is to be transferred to a frame hive, see that the latter be ready, and find your instructions in the chapter on "Swarming."

If it be determined to commence with an old stock, a very good time to purchase is either in February, March or April, thus gaining the advantage of the swarm when it comes. In choosing an old stock, do not buy a weak one at any price; stand before the hives on a fine mild day and note those from which the Bees are busiest; buy such a one or none.

If the stock be bought within a mile or so of home, it should not be taken at once to its permanent resting place, or the Bees on their next flight will most likely go back to their old quarters, and thus be lost to their purchaser; if possible, let it be removed at least two miles off, and remain there a week or ten days; after which, it may be brought home in safety. Evening should be chosen for the removal, or otherwise many may be abroad; but whenever it becomes a necessity that Bees should be removed during the day, administer a puff of smoke into the entrance of the hive. After this, those at home will be disinclined to go out, and in the course of half an hour all the Workers will have

returned; the smoking should be repeated if it be found that the Bees are recovering from the sedative before the necessary time has expired. They should be moved or disturbed as little as possible in bad weather, for if they be excited and unable to take wing to relieve themselves within the next day or two, dysentry will very likely be engendered. The value of a stock of Bees depends on their abundance in the neighbourhood, the season of the year, and the strength of the colony. Of course, in the autumn, when the dangers of the winter are all to come, they are not so valuable as in the spring, when they will, probably, soon swarm. Having bought an old stock, we have no option in the kind of hive to be used; whatever they are in must be made the best of, at any rate for a time. A novice could not satisfactorily transfer the Bees and combs while they are full of brood and honey, but if it be particularly wished to locate them in a frame hive, the transfer will become much easier sixteeen to twenty-one days after the issue of a swarm; at this time the combs are free, or nearly so, of brood. Supposing the old Queen laid on the day of her departure, her last Worker egg will be hatched in twenty-one days, and the young Queen has not yet or only just began to lay, the combs will, therefore, be light and manageable. The chapter on "Transferring" will give full instructions how this operaton may be successfully performed. In settling the locality in the garden where the hives shall be placed, do not trouble about the aspect, it is immaterial, but seek if possible to place them where they may be sheltered from high winds and drifting rain. The shelter of a shrub or tree is very welcome, and they will be more likely to pursue their labours

peacefully without annoyance to the frequenters of the garden; they are apt to be irritable if blown about by high winds.

Columella, who wrote two thousand years ago, gives the following advice for the situation of an apiary:—

"It were desirable that it face the south, and be "situate in a place neither too hot nor too much ex- "posed to the cold. That it be in a valley, in order "that the loaded Bees may with greater ease descend "to their homes. That it be near the mansion house, "on account of the conveniency of watching them, but "so situated as not to be exposed to noisome smells, "nor to the din of men or cattle. That it be surrounded "with a wall, which, however, should not rise above "3 feet high. That, if possible, a running stream be "near them; or, if that cannot be, that water be "brought near them in troughs, with pebbles or small "stones in the water for the Bees to rest on while they "drink; or that the water be confined between gently "declining banks, in order that the Bees may have "safe access to it, they not being able to produce either "combs, honey, or food for their maggots without water. "That the neighbourhood of rivers or basins of water "with high banks be avoided, because winds may whirl "the Bees into them, and they cannot easily get on "shore from thence to dry themselves. And that the "garden in which the apiary stands be well furnished "with such plants as afford the Bees plenty of good "pasture. The trees in this garden should be of a "dwarf kind, and their heads bushy, in order that the "swarms that settle on them may be the more easily "hived."

Hives should be sheltered from the full blaze of a

midsummer sun; but the whole of its grateful warmth should not be dispensed with, some heat being necessary to dry up moisture. Perpetual shade is bad; extremes either way should be avoided. It is not advisable to crowd the stocks together; spread them about the garden singly, then the Bees will not be likely to fight, or the young Queens to get lost on their nuptial excursions. Stands for the hives need not be expensive; an old stool, box, cask, drain pipe, or log of wood answers very well. Should these look unsightly, climbing plants trained over will soon remedy that defect. About 2 feet from the ground will be found a convenient height for manipulations. The hives being disposed of in their permanent quarters, a careful study of the various chapters that follow will teach the tyro what to do and when to do it. And, if attention be carefully bestowed, before the swarm multiplies itself, or the winter arrives, the novice in Bee-keeping will find himself fully able to cope with any difficulties that may occur.

GUIDE COMBS.

When using frame hives it becomes an absolute necessity to secure straight combs, and as the Bees have no knowledge of their owner's preference, they are very likely, if untaught, to build their combs the way their fancy teaches them, and they often do not forget that the line of beauty is a curve. Now to induce the Bees to build straight, it is only necessary to lay the foundations of the combs for them, and this is done in various ways; the simplest is to cut up good clean Worker comb into straight strips (which need not be more than one or two cells thick), and cement these with melted wax on the underside of the top bar of each frame, taking care that the mid rib of the comb is exactly in the centre of the bar, and that the comb is the same way up as it was built. A useful cement, always ready for this purpose, may be made by Bee's wax dissolved in its equal weight of benzole. It should be rubbed smooth on a slab of glass or stone, with a spatula, or thin table knife. A layer of this should be spread down the centre of the bar, and the thin strip of comb pressed on to it, in the same manner as a bricklayer would lay a brick. After a few hours' exposure to the air, the benzole will totally evaporate, leaving the wood, wax, and strip of comb firmly united, and

the Bees will be found to work readily on it. In default of comb, the purpose will be answered by drawing a line of molten wax down the centre of each bar; the line of wax need not be more than a quarter of an inch broad, nor thicker than an ordinary playing-card, but it is necessary it should be straight; the Bees will accept that as the foundation of their comb, and work accordingly. A much more elegant and effective way is to furnish the frames with artificial combs, the method of making which is thus described by "A Lanarkshire Bee-keeper." Premising that these artificial combs are wax sheets, impressed on both sides by means of plates made of type-metal, with a *fac simile* of the central part or foundations of a comb of Worker cells which the Bees readily convert and finish into real combs, the cradle of their future young: "Although there may be many different methods of "making wax sheets, such as using a belt of oiled cloth, "glass dippers, or wood, perhaps the latter for the "amateur will be found the best. The first thing to "procure is the genuine wax thoroughly cleaned; next "obtain a vessel of sufficient size to dip the sheets in, so "that their length will be of the width of the vessel, "which is best made on the same principle as a glue-pot. "Having the wax melted, it is well that a supply be "kept to fill up as the material is exhausted in the "dipping pot. A vessel should next be obtained of "sufficient size to admit the dippers, two in number, "made of the best yellow pine, perfectly free from "stakes, knots, or resin-galls, and not more than a "quarter of an inch thick, tapered off at the point. "This vessel must be filled up with cold water and the "dippers steeped therein for some time previous to the

" first dipping, and be plunged in after every dip to keep
" them cool, so that an even surface of wax will adhere
" to them. Having all in readiness, as described, the
" operator must now try his hand at dipping. The
" dipper must first be taken hold of by both hands, to
" shake the water from it ; then take it in one hand, and
" give a sudden plunge into the melted wax and quickly
" withdraw, until the dipper is clear, let it hang for a
" second or two until the wax stops running from it, then
" give a gentle wave of the dipper with its two sheets
" for the purpose of cooling them. If the wax has been
" of the proper heat, two perfect sheets will be ready for
" lifting from the dipper with a common table knife.
" Lift the top edge of the sheet, then catch it with both
" hands, and draw it from the dipper, and it will be
" found to separate from the wet dipper easily ; then lay
" the sheet on a flat table, turn the other side, and repeat
" the process. If the sheets are not of a sufficient
" thickness with one dip, the process may be repeated.
" If the wax crack, or adhere very thinly, it is a sign it
" was too hot ; next time it may be allowed to cool a
" little if this were the case. It will, perhaps, be as well
" to remark that the vessel holding the wax, and the
" dipper, must be of larger dimensions than the sheets
" are required, in order to allow of pruning, which may
" be done in the following manner : Lay the sheet upon
" a flat board, having another piece of wood as a pattern
" the size the sheet is required, lay this on the top, then
" with a pocket-knife cut to the size. The sheets at this
" stage are now ready for pressing, which may be done
" in the following manner : Mix a little soapsuds in a
" basin, and with a sponge wet the plates ; having now
" your sheet handed to you by an assistant, who has

" warmed it moderately at the fire, place it between the " plates and apply the press, with a turn or two the " work is done; now slacken and separate the plates, and " if they have been well soaped the perfectly impressed " and straight sheet is easily lifted. A piece of thin " wood must be used above the plates, well fitted, so that " the press (a common copying one will do) presses it " equally." Plates for making these sheets are sold by Messrs. Neighbour and Sons, Regent Street, London; and those who would rather buy than make can be supplied by that firm with the sheets all ready for use. Mr. Alfred Neighbour in his book *The Apiary* says :—

" An inspection of a sheet of comb will show that " the division of the opposite cells is made by a thin " partition wall common to both. Now the substance " of this is said to be only the 1-180th part of an inch, " while the artificial ones are between the 1-30th and " 1-40th of an inch, more than four times the thickness " of the handiwork of the Bees themselves. It would " be in vain to attempt to furnish sheets of wax at all " approaching this delicate fabric ; the impressed sheets " are quite as thin as they can be, to bear the handling " which is requisite for fixing them in frames. We " find, however, that this thickness is no disadvantage ; " the Bees speedily excavate and pare the artificial " sheet so as to suit their own notions of the substance " required, then with admirable economy they use the " surplus thus obtained for the construction of the cells. " After a sheet is partly worked at by the Bees, it is " interesting to hold it up to the light and observe the " beautiful transparency of that part of it contrasted " with the opaqueness of the part not yet laboured " on."

When a sheet or strip of this impressed wax is properly fixed to the bar, it is certain to be the guide and foundation of a straight comb. It is not necessary, although advantageous, that the sheet should be, when fixed, the whole perpendicular height of the comb; given a fair start of 3 or 4 inches, the Bees will continue in the same line to the bottom of the frame. For supers, 2 or 3 inches will be found sufficient, and will dispense with the necessity of fixing natural decoy combs. To these wax sheets the Scotch Apiarians owe the remarkable and beautiful regularity of their show supers in Stewarton boxes.

The best way to fix these sheets in the frame is to cut with a saw the bar half-way through, insert the edge of the wax sheet, and run a thin stream of molten wax down the angle formed by the junction of the sheet and bar. The bar may be wholly cut in two, and the sheet being inserted between the two halves screwed or tacked together again, or it may be cut through with a keyhole saw *nearly* its whole length, the edge of the sheet passed through and made secure by passing a heated iron over the upper surface of the bar; or fix a strip of wood, half the width of the bar, with brads to the underside, place the wax sheet against this, and tack another strip up close against it, and the artificial comb will then be firmly fixed in the centre of the bar.

QUIETING BEES.

"With sprinkled water first the city choke,
And then pursue the citizens with smoke."—VIRGIL.

WHEN performing any operations on Bees, either depriving them of their stores, making artificial swarms, or transferring from one hive to another, as well as the thousand and one things that an experimentalist finds himself called upon to do, it becomes very desirable to subdue the Bee's anger, or so to manage that they shall never become irate; and many schemes have been proposed for this purpose, but they have nearly all resolved themselves into one grand solatium "Smoke." Chloroform and burning fungus used to be the means practised, but it was found that although they recovered from the insensibility produced, the health of the Bees suffered—so now "Smoke" has taken their place. The Americans for this purpose use a roll of cotton rags, an inch or more in diameter, and rolled just tightly enough to burn, and not blaze. At times a little tobacco is sprinkled between the rags, and rolled up with them. We in England have pinned our faith more on tobacco alone, and with those who are smokers nothing is easier than to light up in a long clay pipe, give a good deep draw, and while the smoke pours out freely, apply the small end of the pipe to the hive's entrance; but with ladies, and with those to whom the pipe is an abomination (as it is with me), some other

means must be adopted; and it will be sufficient if I describe two little appliances which are in general favour. The first is the invention of Mr. F. Cheshire, for which he obtained a prize at the Crystal Palace, for its simplicity and utility.

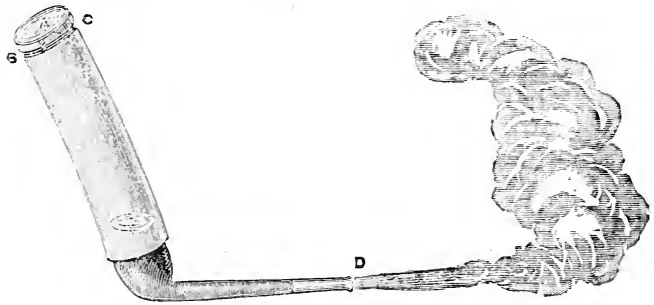


Fig. 38.

It is formed of a simple briar root tobacco pipe, costing about 6*d.*, which is partly filled with tobacco or rags. A lighted fusee is dropped into the bowl, over which a piece of India-rubber tube, one end of which is plugged up, is placed as shown in the engraving (Fig. 38), when by alternately pressing and releasing the tube in the hand, smoke will be driven out of the small end of the pipe, and may be directed where desired. The other instrument was invented by the Hon. and Rev. H. Bligh, either as a simple "Quieter," or fumigator to insensibility; for the first purpose, the nozzle is removed and the tobacco placed within it, then being replaced, the working of the bellows will eject the smoke where directed. For the latter purpose (seldom, in my

opinion, desirable) the tube is first fixed into a wooden delivery pipe; the puff-ball torn in small pieces is

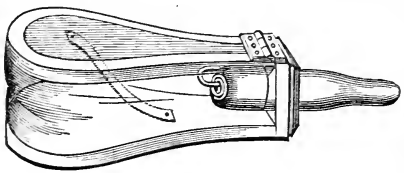


Fig. 39.

then crowded into the tube. A lighted vesuvian thrust into it, the wooden mouth-piece inserted, and the instrument is ready for use. When commencing operations on a stock of Bees, a puff of smoke will be found a wonderful quieter—it should be sent into the hive's entrance or under the crown board, and the Bees then left quiet for a few minutes—the effect is extreme alarm, and in all such cases the Bees rush to their honey stores, and fill their honey bags against contingencies. Once filled they are harmless, although of course *all* the Bees do not get into that state. Oftimes when operating on Bees it will be found advantageous to sprinkle them more or less with syrup; this should be poured from a fine rose watering-can (if in cold weather it should be warmed); the Bees then become so busy cleaning themselves and their companions that they have no time to think of stinging.

Queen Bees are imported from Italy in little deal boxes about 5 inches square, a Queen accompanied by about a hundred Workers; and on lifting the cover a remarkable proof is afforded of how much our irritable little friends may be subdued. Open the box, there they are, a fluttering, buzzing little swarm, each Bee

armed with a sting and two pairs of wings, but showing not the slightest inclination to use either, as harmless as so many flies. Hold the box in hand, they buzz and seem to boil over the edges, running about the hands; and having apparently ascertained all about it, back they go to attend their liege sovereign without any attempt to investigate further, or revenge the indignities they have lately suffered. This state of subjection is the whole secret of driving; it may be summed up in one word, "terror." Only thoroughly alarm the Bees and they become tractable and harmless.

When manipulating much with the Bees, the Apiarian soon discovers certain stocks that are much more peaceful than others; these may be noted as show stocks to one's friend, who will often become quite bold after seeing the way in which the Bees are handled. Half-breeds, the cross between Ligurians and English Bees, have the reputation of being very irritable, and I think it is well founded, for I had a stock of such last year who were certainly the most vicious little rascals that ever I met with. When Bees mean mischief, they emit a certain note which I call their angry buzz; this is soon learned by their owner, who can often avoid being stung by regarding the warning.

DRIVING

Is the art of compelling Bees to leave one hive for another, either to facilitate the making of artificial swarms, to enable us to deprive the Bees of their stores, to strengthen the population of stocks by adding two or more together, to capture the Queen for the purpose of introducing a Ligurian, or making other exchange. Driving is principally done upon stocks in skeps; with frame hives it is not usually required. The *modus operandi* is very simple, and, properly managed, should seldom fail. Some writers have gone so far as to assert it is simply absurd to imagine that a stock of Bees will leave their well-furnished hive for an empty one at the bidding of the Bee-master. I can only say *they will*, and the stronger and more active the stock, the sooner they will go. On a cold day, with very weak or Queenless colonies, I have sometimes found the Bees unpersuadable, or only going after a long exercise of patience; but at other times from ten minutes to half an hour is generally sufficient. It has often struck me as surprising how any one can fail to drive the Bees under favourable circumstances; that beginners do often fail is incontestible, but having once passed the *pons asinorum*, the successful Bee-keeper feels surprise how he could have failed in such an easy operation. When once the work is begun never give in until completed satisfactorily. It becomes only a

question of time, *the Bees must go.* Supposing now it is desired to expel the whole of the Bees from their hive, and it is the operator's first attempt to drive, I would suggest the following method of procedure, which, if followed, will result successfully: In the middle of a fine day, when a good many Bees are abroad, commence by blowing two or three puffs of smoke into the hive you desire to drive, then give it a smart open handed smack on each side, and leave it; the smoke and the smacks immediately put the Bees into intense excitement, and after, perhaps, an alarmed sally to the entrance to take stock of the enemy, every Bee proceeds to fill herself with honey to be prepared against contingencies. Whilst this is going on, get ready a pail or stand on which to set the hive, a pail is best if the hive is round topped, as it will be held more secure; also two empty skeps, two sticks about 1 inch in diameter, and two iron skewers, and if the operator be timid, a round towel as well as 2 or 3 yards of stout string; five minutes will have by this time elapsed. Now the hive must be boldly lifted off its floor board and placed mouth upwards in the pail or on the stand, and another skep of the same size placed (mouth to mouth) on the top of it. On the stand where it came from, place an empty skep to amuse the Bees who come home whilst we are operating. The round towel may now be wound round the juncture of the two hives and secured with the string; this, after the experience of a few drivings, will be dispensed with. Now, with the two sticks, or with the open hands, smartly strike the sides of the full hive, keeping up a continual drumming; the Bees become terror stricken, and, after a time, start in a

stream for the upper hive, giving out a rushing sound which may be plainly heard if listened for. The emigrants are now harmless and will neither fly away nor sting, consequently the towel may be removed, and the top hive tilted up to an angle of 45 degrees, being kept in position there by the two skewers, with which pin the hives together right and left of their point of junction, which must be at the place where the swarm of Bees is thickest. The progress of the exodus being watched, and a sharp look-out kept, the passage of the Queen will probably be seen (unless she has already gone up) when she may be captured, if desired, or allowed to proceed with her subjects; when the stream of Bees begins to slacken, look down amongst the combs and, probably, various clusters of Bees will be observed; start them with a puff of smoke or stir them with a feather, when they will most likely run to join the main body. Experience will soon give such confidence that it will not be thought necessary to tie the two hives together with the cloth, but proceed at once with the open driving, especially if the object be to capture the Queen only, for she is just as likely to go up with the first rush as to stay till the last. Having succeeded in the driving without seeing the Queen, great care must be taken that she be not left behind in the hive, which should be carefully searched. The Bees that have gathered in the temporary hive on the floor board may now be shaken into the other; or if it be intended to place the driven Bees on their old stand, they may be left to fly home after being removed elsewhere. If driving is attempted in wet or cold weather, or late in the evening, the Bees will often be troublesome to move; and, as a

very little cold benumbs them, numbers who have flown will be lost, from their inability to seek their home, so that this practice should not be pursued at such times without adequate cause; but should necessity arise and it be found or thought the Bees will be reluctant to leave, they may be induced to go, by warming their new domicile and sprinkling them with warm syrup, thus creating the excitement necessary. Mr. Pettigrews employs a method of shaking Bees out of a straw skep in lieu of driving, which he thus describes: "When hives are less than thirty pounds "in weight we shake them out in less than half a "minute; no smoke is used, the Bees are taken "unawares; the hive to receive them is placed on its "crown, the other gently raised off its board (it must "be previously loosened) but not turned up; the Bee-"master now places his fingers inside the hive and his "thumbs outside, the hive being fairly balanced on "his hands, and his legs pretty well astride the empty "hive. He now acts as if he were going to dash the "one he holds against the other, but they never touch; "the Bees, however, go forward and fall into the "empty hive. A few violent thrusts or shakes, well "performed, is often enough to empty the hive of "every Bee. In cold weather, when Bees are sitting "fast among their combs, they cannot be shaken out "without first feeding them by sprinkling. A few "minutes after having been fed they will be found "moving lightly about over their combs, when they "may be readily and easily shaken out in less than "half a minute. We often perform this operation "by candle light. By feeding the Bees about sunset, "and taking them into a room or barn in about half

"an hour afterwards, they can be readily shaken out "on to the floor of the room, and a hive placed over "them, and sometimes there is not a Bee lost by "doing it." This plan may be practised on old hives crossed by the abominable sticks; but from any others I fancy the combs would fall as well as the Bees, which would not be the desirable thing.

NATURAL SWARMING.

"Ten thousand pinions, guided by Thy hand,
Wander, unwearied, through the blue abyss,
They own Thy power—accomplish Thy command,
All gay with life, all eloquent with bliss!"—DERZHAZIN.

THE issue of a swarm of Bees in the bright and merry months of spring, is one of the most beautiful and delightful sights and sounds to be met with in the country side; everybody within view or hearing is attracted by the tumultuous assemblage, and if in a district where old customs are still rife, "tang-tang-tang" is heard on every side as the cottagers turn out with key and shovel to "ring the Bees." It is a popular idea that unless this is done the swarm will be likely to fly to a far distance, and perhaps be lost. I need hardly say the "ringing" has no effect whatever on the Bees, but the pleasant reminiscences connected therewith make it always a welcome sound to hear.

Swarms do not usually issue until May or June, rarely in April. Early swarms are always desirable if the weather be fine and warm, but if it be succeeded by cold or wet, then the early swarm becomes a misfortune; in the first place, the Bees have neither combs nor food, and being unable to go out foraging, must necessarily perish, unless fed regularly. The Mother hive also, lately so crowded, misses the comfortable warmth generated by its departed population and the Nurses with difficulty keep the temperature

sufficiently high to mature the brood, so that in this contingency it will be seen it is more desirable for the swarm to issue later, when the weather can with more certainty be depended on.

Swarming is an act of necessity, not choice, and is a provision of Nature to relieve an over populated colony. It is in fact an emigration on a large scale.

The chief indication that swarming is about to take place is the gathering of the Bees at the entrance of the hive, where they cling to each other and hang under the board in a cluster, often as large as a pottle measure. This clustering is evidently the natural instinct of the Bees, which leads them to gather together in the same manner as when they are making comb within the hive, and indeed they will sometimes start a new comb under the floor board. The hive being quite full, the Bees will often thus "hang out" for two or three weeks, though something is apparently yet wanting to give them the final impulse to start. Clustering does not always take place before the issue of a swarm, so that other signs must also be watched for. If on one day the Drones are busy, and the Bees all activity and bustle, while on the following day few Bees are at work, and only a little restlessness observable, then we may probably expect a swarm at no very distant date; but there are no infallible signs by which the Apiarian can predict an immediate issue, more especially if it be a first.

The issue of after swarms may often be foretold by a shrill piping sound, to be heard in the interior of the hive, one or two days previously, the cause of which I will presently explain.

It is rarely that a swarm will come forth in bad

weather; fine still days are generally selected, seldom earlier than nine or later than three o'clock, and most frequently between twelve and two. As soon as the hive becomes inconveniently crowded, and Drones make their appearance, the Bees prepare for swarming by building a number of royal cells, and this having been done, the old Queen's instinct soon teaches her it is time to abdicate. The first swarm is invariably accompanied by the old Queen, and she usually goes off as soon as one or more of the royal cells be sealed over; but even although the royal cells have arrived so far towards maturity, swarming may yet be stopped by unfavourable weather or other causes, in which case the embryo Queens will be destroyed. Previous to swarming, her majesty becomes very restless, and instead of proceeding with her usual important business of egg laying, roams restlessly over the combs. Her agitation infects the whole colony; they rush to the honey cells, fill their honey bags, and fly in and out the hive as though impatient for the important event. At length a violent commotion ensues; the Bees become almost frantic, whirling round in circles, continually enlarging, until at last the whole hive is in a state of the greatest ferment, and the Bees, rushing impetuously to the entrance, pour forth in one steady stream.

"Upward they rise a dark continuous cloud,
Of congregated myriads numberless,
The rushing of whose wings is as the sound
Of a broad river headlong in its course.
Plunged from a mountain summit, or the roar
Of a wild ocean in the autumn storm,
Shattering its billows on a shore of rocks."—SOUTHEY.

It is generally supposed that the Queen leads the

swarm, but this is not the case; she may come out with the first rush, or at any other time; as also on alighting she may be the first, or the cluster may form without her being there. If, however, she does not join soon, the Bees will scatter again and seek her. Often, when full of eggs, she is so heavy that a long flight is impossible to her, and she falls to the ground where the Bees will be sure to find her. Should the Queen be lost, the bereaved colony will exhibit the greatest agitation. Bees will be running about the entrance and up the sides of the hive searching everywhere for their beloved sovereign. This commotion is very noticeable the morning following the loss, while other colonies are quiet; after a day or two they become resigned. Once out, the Bees scatter themselves in the air like countless stars in the firmament; they dash hither and thither, whirling about with a pleasant noisy roar that may be heard at some distance; the whole atmosphere seems alive with Bees passing and repassing. They must now be attentively watched, when they will probably be found gradually converging together and settling down in one mass on some neighbouring bush or tree; although they will often, apparently not feeling satisfied with the home neighbourhood, fly far away, when the owner stands a good chance of losing them altogether. It is said that throwing up sand or dirt, flashing a mirror, or firing a gun amongst them, will often cause them to come down, but if these means fail, the owner has no resource but to keep his eyes and legs in the greatest activity, and follow the swarm until it settles. Seldom a neighbour will refuse a civil request to be allowed to enter his premises to reclaim an errant swarm, and the

law of England is, that a right of property in Bees can be claimed so long as the swarm has been kept in sight, and the owner has the power to follow them on any man's land, with the proviso that compensation shall be made for any damage that he or his Bees occasion. Should the swarm be lost and no stranger hive them, they will often, after a few hours, return to their old hive, apparently disgusted at the neglect they have experienced. In this case they may be expected to emerge again on the first favourable opportunity.

In the case of a colony who will persist in repeatedly swarming, or if the Bee-keeper fears a swarm will issue and be lost, this may be prevented by clipping the Queens wings; she may probably come out after this, but will be found not far away, as she, of course, would fall to the ground, her journey afterwards being limited to the distance she can crawl. This plan was known to Virgil, who says :—

> "The task is easy: but to clip the wings
> Of their high-flying arbitrary Kings."

The ancients styled the Queen—the King.

At the time of the old Queen's departure, the royal cells are generally arriving at maturity; in about a week one of them hatches, and the natural impulse of the new born Princess is to destroy all her unhatched sisters; but if the hive be in that prosperous condition that another exodus is desirable, the Workers prevent this sororicide by setting a guard over the unhatched Queens; and when the reigning Queen approaches them she is driven unceremoniously back; she resents this interference by a quick succession of shrill angry sounds, not unlike the rapid utterance of *peep, peep, peep*, which is accepted by the imprisoned young

Queens as a kind of challenge, and answered by them from the interior of their cells. This is called piping, and when heard is a sure sign of another swarm. The young Queens are all mature at the latest sixteen days from the issue of the first swarm; and Langstroth says, if during this period these notes are not heard, it is an infallible indication that the first hatched Queen has no rivals, and that swarming is over for the season in that stock.

The second swarm usually issues on the second or third day after the piping is heard, though when the weather is unfavourable it may sometimes delay coming out until the fifth day. When using frame hives the issue of second and later swarms may always be prevented by destroying the Queen cells. Too frequent swarming is very injurious, as it leaves the original colony very weak, and the swarms are in the same condition; in fact, it divides a thriving stock into a number of weak ones, which, collectively, will not be so productive as one strong colony; therefore, unless under exceptional circumstances, after swarms should be discouraged. From a stock which swarms more than once no surplus honey can be expected, the largest returns of honey being from the hives which have not swarmed at all.

I will now suppose the swarm has issued, settled down, and all become quiet. The next thing to do is to hive it. Whatever hive is intended to become their permanent domicile, a straw skep is the best and handiest thing in which to bring home the Bees. Let the skep be clean and free from loose and ragged straws. If the Bees are intended to remain in it, see that the flight aperture is neatly cut, and the feeding hole well

bunged up. Many persons run two sticks across the hive, at right angles to one another, to hold up the combs, and drench the inside of the hive with sugared water or beer, at the same time rubbing it round well with a bunch of sweet herbs. To the syrup I have no objection, although it is unnecessary; but the sticks and herbs are far better left out—the one becomes a nuisance in after manipulation, as well as causing crooked combs, and the herbs may not suit the organs of taste or smell of the Bees; that which we think is nice they may consider nasty. The floor board, which, of course, must be perfectly clean, is then placed handy on the ground, with a stout stick laid across a few inches from the alighting board; and duly equipped with veil and gloves, we are ready for operations. In all probability the swarm hangs on a bough or bush; in this case, all we have to do is to hold the hive fairly beneath and give the bough a vigorous shake, when the cluster will fall into the hive, and before the Bees can recover from their astonishment set it down on the floor board across the stick, which will tilt up the hive and prevent crushing; although, in inverting the hive on to the floor board, the Bees will fall on it, they will quickly run up again and cluster as before; and, provided the Queen be with them, every Bee outside will in a short time enter. If, on the contrary, the Queen be not shaken into the hive, it will quickly be deserted, and very likely the cluster will reform on the old spot, when the process must be repeated with, let us hope, a better result. It sometimes happens that when the Bees are apparently hived satisfactorily, they are not satisfied, but, issuing again, return to their old habitation or seek another home, when the same care in marking down and follow-

ing must be pursued. Bees are not always so complaisant as to select a bush or bough to hang upon. The face of a brick wall is an awkward spot, and I have known them swarm upon that. The boll of a tree is a common place. In these cases they must be swept into the hive with a brush or goose's wing in the best manner possible under the circumstances; or the inverted hive may be supported over them and the Bees driven upward with a little smoke. When in an awkward place, the Apiarian's ingenuity must be exercised to devise the best manner in which the desired object may be attained, bearing in mind that Bees have a tendency to ascend, and may be more easily driven or coaxed upwards than downwards. A swarm should be hived as quietly as possible after they have quietly settled down, for if not secured within an hour or two they will probably leave again. After being safely hived, and the stragglers gathered to the main body, the stick may be taken away, and the new colony placed at once on the stand it is to occupy. If this be not done *at once*, it will be better to leave it quietly until evening, shading the hive from the sun's heat by an umbrella or green boughs, as after the commotion of swarming has subsided, the industrious Workers, losing no time, will proceed to gather in some stores, and on their return, not finding the hive, will perish. The Bees forming a swarm always emigrate with their honey bags full. They have provision enough to last them three days; and if it be found at the expiration of that time that the weather is unfavourable for work, they must be fed, or if the famine continues they will die. It should be remembered, as if written in letters of gold, that Bees waste

nothing, and so no loss can occur by feeding them. I cannot reiterate the fact too often, that it is false economy to stint Bees in food; they will not gather an ounce less of honey if they are supplied with an unlimited amount of syrup; on the contrary, the grateful nourishment will invigorate and make them work still harder. Should the Apiarian be desirous of stocking a frame hive with the swarm, let it remain quietly in the skep till five or six o'clock in the evening; spread a sheet or large newspaper on the ground near where the stock is to stand, and on it place the selected hive with its frames (which should have been previously furnished with guide combs) in position; prop up the front an inch or so with a stick or stone, let the crown board remain on, then gently lift the skep, bringing it up to the frame hive, and with a quick, sharp jerk, shake the whole of the Bees on to the sheet immediately in front of the hive's entrance. The Bees will be so alarmed and terror-stricken at all the occurrences of this eventful day, that scarcely one will fly or sting but make all possible haste to run under and up into the hive placed for them; they may be assisted in this by gently sweeping them towards the entrance with a brush, stiff feather, or goose's wing. Search the skep well to make sure the Queen is not left behind, a few Worker Bees will not matter. It will soon be perceived, if the Bees are entering the hive quickly, if so, the Queen is there and all will go well; but, if her majesty be absent, the Bees will crowd all about the outside of the hive, and although they may go in, they will not remain there. Finding this to be the case, we must seek an interview with her majesty, examine every little knot of Bees round about, for the Queen will

seldom remain many minutes alone. Her faithful subjects crowd about, anxious for her safety, until a miniature swarm is formed, which, if not disturbed, will remain for days, until all the individuals composing it are dead of starvation and exposure. Should the Queen be found, introduce her to the hive and it will then progress satisfactorily. After the Bees have all entered, gently lift up the hive, place it on its floor board, cover all up secure from cold and wet, and bearing in mind the caution as to feeding in bad weather, we may leave our young colony to fulfil its appointed task.

Should two or three swarms issue together or within a few hours, and the owner be not anxious to increase his stocks, these may be profitably amalgamated; three swarms put together will gather more honey than if kept separate. The best way to unite them is to hive them in separate skeps, then place the hive intended for their permanent abode on a sheet, and proceed as I have described for stocking a frame hive, when the other swarm or swarms may be shot down in front. It is advisable to well sprinkle each swarm with syrup, scented with peppermint, before uniting them; fighting will, by this precaution, not be likely to occur. If the Apiarian has no preference for either Queen, their majesties may be allowed to determine the right of sovereignty themselves; but if it be desired that a particular Queen should be the survivor, the others must be sought for and removed; this may be done by searching for the Queen when on the cloth, each lot separately, and not allowing the Workers to mingle until they be found. A Queen is very easily missed, and a tyro will, perhaps, find this a troublesome and difficult work.

The Bee-keeper is often sadly disappointed after all his trouble in hiving the swarm, to find in a day or two the Bees will not accept their quarters. Something is wrong about the hive which we cannot always define, and the swarm issues again; in this case it is advisable at the next hiving to use another hive, for if you put them into the same as before, they probably will again desert it. If two swarms cluster together, they may advantageously be kept together, but if it be wished to separate them, the following plan may be pursued: Having hived the doubled swarm, drench them well with syrup from the rose of a watering can; then, having placed two other hives on a large sheet, shake down the Bees midway between them, and with a feather direct a stream of Bees towards the mouth of each; probably a Queen will go each way, but keep a sharp look out, and if you can capture both Queens, the process becomes simple. Give one to each hive, and with your feather arrange the stream of Bees so that they shall be about equally divided; if one Queen only be captured, and the Bees are found quietly entering one of the hives, the other Queen is doubtless there; but if the Bees are disinclined to take possession of either domicile, then the Queen is still, probably, on the cloth, and the search must be continued.

Should second or third swarms issue when they are not wanted, they may be returned in the evening by shaking them out on a sheet before the entrance of the hive from which they issued, they will immediately run in.

The increase of colonies by natural swarming requires the least amount of knowledge or skill, and will, with those Bee-keepers who have not acquired some degree of

scientific apiarian skill, be for long the only method allowed. Langstroth cites the following objections to natural swarming, which are, without doubt, well founded: "First. A serious objection to reliance on "natural swarming is the vexatious fact that swarming "hives are so constructed that although Bees often "refuse to swarm at all, they cannot furnish to their "crowded occupants sufficient accommodation for storing "honey. Under such circumstances, hordes of useless "consumers will often (for months) blacken the outside "of the hives to the great loss of their disappointed "owners. Second. Another objection to natural "swarming arises from the disheartening fact that "Bees are liable to swarm so often, as to destroy the "value of both parent stock, and its after swarms. "Experienced Bee-keepers obviate this difficulty by "making one good colony out of two second swarms, "returning to the parent stock all after the second, and "even that if the season be far advanced. In frame "hives, second swarming may be prevented by re- "moving all the Queen cells but one, after the first "swarm has left; by removing all but two, provision "may be made for the issue of second swarms, if "thought desirable, and yet all further swarming be "prevented. After swarms, in many instances, have "to be returned again and again before one Queen is "allowed by the Bees to destroy the others. In this "way a large portion of the gathering season is often "wasted, as Bees seem unwilling to work with their "wonted energy, so long as the pretentions of several "rival Queens remain unsettled. Third. Another very "serious objection to natural swarming as practised "with common hives is, that it furnishes no facilities

"for making vigorous stocks of late and small swarms. "The time and money devoted to feeding small colonies "are usually wasted, as the larger portion of them "never survive the winter, and most of those that do "are so enfeebled, as to be of little value. The more "of such stocks a man has, the poorer he will be, for "their weakness constantly tempts his strong stocks to "plunder them."

ARTIFICIAL SWARMING.

To the perfection of methods of compelling Bees to swarm at will, Bee-masters have long devoted their attention, and the use of bar-frame hives offers great and valuable facilities for this purpose. How annoying it is, after having carefully watched a stock apparently ready to swarm for perhaps a week or two, when our attention has been unavoidably withdrawn for a time, to find that the Bees have issued and gone away, no one knows where. Apiarians engaged in business elsewhere than at home, have often but a poor chance of hiving their swarms; therefore, a knowledge of some means of artificial swarming is desirable. Straw skeps and frame hives require different procedure; for the latter there are several plans; for the former but one, which is *driving;* the method of this is explained in its proper chapter, therefore, I will now merely point out when it may be resorted to. The most notable time is when the Bees hang out—this would not happen unless the hive were overpopulated; therefore, it is desirable to give immediate relief by driving, or what may be better called, forcing a swarm. In driving for as warm, it is essential that a fine day be chosen and the driving performed as I have elsewhere given instructions. When a sufficient number of Bees are driven into the empty skep *with the Queen* (*she being indispensable*),

the old hive may be examined, and if it still contains enough young Bees to cover the brood, nothing remains to be done but to place it on a new stand, at some distance from the old one. The population will quickly be increased by hatching out, and if no Queen cells are in existence, the Bees will immediately start some, and a Queen will be hatched in from ten to sixteen days, according to the age of the larva or egg that has been converted from a Worker to a Queen. If the Apiarian can obtain a sealed Queen cell, or better still, a fertile Queen, supply the hive with it at once, taking proper precautions against the destruction of it by the Bees. This will materially reduce the time during which the breeding ceases. If it be found *after the swarm is driven* that the stock hive is bare of Bees, which, unless the Queen is known to have gone with the swarm, is advisable should be the case, then, by some means, the combs must be again populated. This may be done in various ways. The swarm may be sent away a distance of at least a mile and a half, and the old stock be replaced on its former stand; the Bees which return home from the fields will then be found sufficient to carry on the work of the hive. After a few days the swarm may, after sunset, be brought back, when they will have forgotten their old locality. Another way is to place the denuded hive on the stand of some other strong stock in the apiary, removing that one a few yards away; the returning Bees, although probably very much surprised at the new order of things in their home, will not hesitate to make the best of their misfortune and proceed to hatch the brood and raise a Queen. In the swarming season the combs of a strong stock contain

such an immense number of young Bees, in all stages of development, that the hive soon becomes as populous as before. Once let the Bee-keeper master the art of driving and he will no longer allow his Workers to hang out idle, or risk the loss of a swarm by waiting the pleasure of his Bees.

Where artificial swarming is carried on on a large scale, Langstroth has devised an ingenious plan to repopulate denuded colonies :—

"Let the Apiarian obtain a forced swarm from some "Bee-keeper a mile or two off. Bring it home and "confine the Bees, allowing plenty of ventilation, until "late in the afternoon or early next morning, then let "him force four or five swarms, placing them at once "on the stands of the parent stocks, and these latter "where it is intended they shall permanently remain. "The imported swarm should now be shaken out on a "sheet and sprinkled with syrup, to prevent the Bees "taking wing. With a saucer scoop up, without hurting "any of them, as many Bees as you can, and carry "them to the mouth of one of the old stocks from which "you have driven a swarm; continue to do this until "you have about equally apportioned the Bees. These "Bees, having no previous home in your apiary, will "adhere to the different hives in which they are placed, "and thus, without any further trouble, your parent "stocks and forced swarms will alike prosper. If the "Bee-keeper cannot conveniently obtain a swarm from a "distance, he may use for this purpose the first natural "swarm which comes off in his own apiary, and by "delaying to make artificial colonies until natural "swarms begin to issue, every such swarm may be "used for forming at least four artificial ones."

Dr. Donhoff gives a method to secure a colony which, when divided in the way above mentioned, will not forsake their new habitations :—

"On a fine evening, when the next day promises to "be bright, drive out a swarm and set it in the place "of the parent stock; next day, when it is warm, pour "some honey amongst the Bees, and in a few hours "they will swarm."

A forced swarm may also be made to take kindly to their new quarters in the following way: Secure the Queen, and when the Bees show that they miss her, confine them to their hive (properly ventilated), until their agitation has reached its height. Then release them; and, as they begin to take wing, present to them their Queen, when they will cluster round her, and may be treated like a natural swarm.

I will now endeavour to describe the means by which advanced Apiarians form artificial swarms in frame hives. In the first place, if it be simply required to force a swarm for the purpose of supplying some one else with the Bees, a sufficient number may be obtained by shaking or brushing the combs into a skep, or on a sheet in front of it, taking care that the Queen be not injured and that she accompanies her subjects. Once in the skep, the Bees may be prevented from flying by watering them with syrup, and may then be securely tied up; but if the swarm be required for a frame hive, we may proceed as follows: Having a hive with frames of the same gauge as the one that is to supply the swarm, bring it to the side of the other, administer a puff or two of smoke, uncover, and when the crown board is removed, sprinkle the Bees with syrup. Now search for the

comb on which the Queen is; having found it, transfer with any more frames of brood that can be spared to the new hive, and having placed in their places the remaining frames, furnished with clean empty Worker combs, if possible, stand this hive in the situation of the full one, the returning Bees will people it and form a swarm. Another stand must be found for the old hive, a good many of whose Bees will desert it and tend to strengthen the new colony, headed by their old Queen, but enough will remain to carry on the business of the hive. If any sealed Queen cells are known to be, or can be found in any other hive, one may be given with advantage to each stock deprived of its Queen; time, which is all important at this season, is thus saved. By making one artificial swarm a week or ten days before the others, there may in the swarmed stock generally be found sufficient Queen cells to supply many hives; and in case a young Queen should emerge, they may be preserved from destruction by covering them with a cup Queen cage, or one of Mr. Carr's pattern. Of course it is preferable to supply the swarmed stock with a fertile Queen, if possible, as it must always be remembered that this saves one or two weeks of breeding time in the height of the season; and as a young fertile Queen will lay 2,000 or 3,000 eggs per diem, the gain may be easily calculated. In forcing swarms, be satisfied with one from each stock, or even two out of three; prevent the issue, if necessary, of any more, and if the Bees have surplus energies, let them use them to gather honey, for it is a well-known axiom that if many swarms are made there will be little honey; the reason is obvious, the labour of the Bees

is expended in nursing the young and providing them with sustenance, and this with a population constantly being reduced.

In removing frames from a hive, note should be taken of the order in which they are found, and they should be replaced in the same order or they will not fit, and in some places the Bees will find no passage by which they can feed the brood.

QUEEN-BREEDING AND NUCLEUS HIVES.

"When bursting forth to life and light,
The offspring of enraptured May,
The Queen Bee, on her pinions bright,
Launched in full splendour on the day.

Trembling with joy awhile she stood,
And felt the sun's enlivening ray,
Drank from the skies the vital flood,
And wondered at the prospect gay.

She balances her filmy wings,
Thro' fields of air prepared to sail,
Then on her vent'rous journey springs,
And floats along the flow'ry vale."—Roscoe.

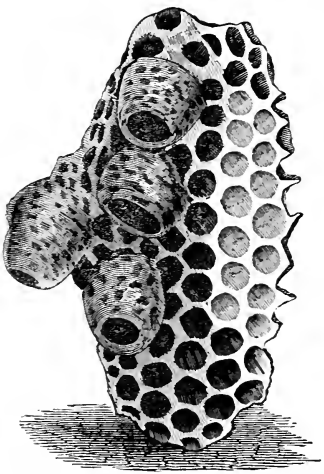


Fig. 40.—Comb with Queen Cells.

The practical Bee-keeper will soon see the many

advantages acquired by having on hand fertile Queens. Quinby says: "The introduction of a mature fertile "Queen to a colony two weeks sooner than when they "swarm naturally is an advantage sufficient to pay "for extra trouble. The time gained in breeding is "equivalent to a swarm." According to Monticelli, the Greeks and Turks of the Ionian Islands knew how to make artificial swarms, and the art of producing Queens at will has been practised by the inhabitants of a little Sicilian Island called Favignana, from very remote antiquity, and he even brings arguments to prove that it was no secret to the Greeks and Romans; but it is not noticed by Aristotle and Pliny. After a stock has swarmed, which takes place usually in the height of the busy time, much time is lost by the parent stock raising a new Queen, and when raised she has to get fertilized, which may not happen for two weeks or more; all this time breeding is suspended, and as mortality is very great in the summer the former strong stock probably dwindles; and if the young Queen on her excursion meets with any mishap, the stock will die, as it then has no eggs or young brood with which to rear another Queen. If the Bee-master be able to supply it with a fertile Queen, immediately on the issue of the swarm—no time is lost—breeding is kept up, and in a few days, if desired, the hive may be induced to swarm again, or the Bees may be set to work, provided honey be abundant, to fill a super. By never leaving a hive without a fertile Queen, I may safely say its increase is doubled.

On the Continent of Europe, and in America, there are many establishments devoted to breeding small

swarms for exportation, and Queens alone, a large business being done. By these means the Ligurian, or Italian Bee has become naturalized in both Continents as well as in Australia, and my object now is to describe how the practical Apiarian can rear any number of Queens he pleases. For this purpose small hives, called *Nucleus Hives*, are used; they may be of any desired size, but it is necessary to work from frame hives of some description. The "Cheshire" Prize Nucleus Hive, which is intended for use with Woodbury hives, is a very excellent pattern; it is $3\frac{3}{4}$ inches wide inside, 9 inches deep, and $7\frac{1}{2}$ inches from front to rear. It has double sides—inner $\frac{1}{2}$ inch wood, outer $\frac{3}{4}$ inch, with strips between, so as to inclose an air-space all round; the back and front have a $\frac{3}{8}$ inch rabbet at the top, similar to a Woodbury hive, for the frames to rest upon. The object of having an air-space all round is, that the necessary heat may be retained, which is very important; and to assist in this it is desirable to varnish or paint the hives white. Mr. Cheshire employs the following ingenious contrivance to facilitate stocking his nuclei. Instead of following the ordinary pattern of Woodbury frames, a little deviation is made, forming what is called "Twin Nucleus Frames." I take the following description and drawings from the columns of *The Country* :—

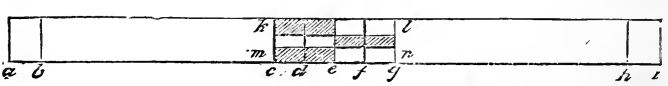


Fig. 41.

"A strip of wood, Fig. 41, 3-8th of an inch thick, "and 7-8th of an inch wide, is cut into $16\frac{1}{4}$ inches

" long, and pencil lines, *b* and *h*, are drawn across " it at 5-8ths of an inch from the extremities; the " line *e* occupies the centre, exactly $8\frac{1}{8}$th inches from " each end, and *c*, *d*, *e*, *f* and *g* are placed at 5-8ths " of an inch from each other; *k*, *l*, *m* and *n* are now " added with a gauge-marker, if one is at hand, and *e* " being cut through with a fine saw, the parts shaded " are removed; the tongue left thus on one half fits " into the hollow made in the other, so that the two " being shut together, the length of the bar is reduced " to 15 inches, and fits the ordinary Woodbury. To the " respective halves with brads or small French nails " the uprights of the frames, each 8 inches in " length, are fixed, having their outer faces upon the " lines *b*, *d*, *f*, and *h*; the bottom bars complete the " whole, which takes the form of Fig. 42. If the

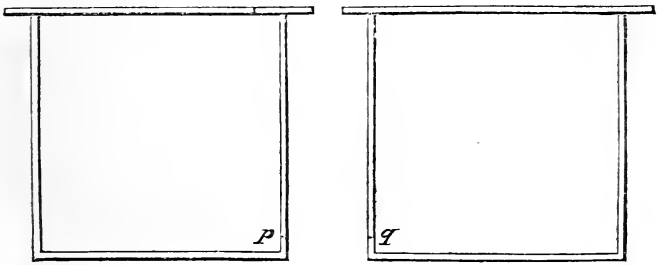


Fig. 42.

" parts be screwed up in a wood-vice whilst driving the " nails, splitting will be effectually prevented. The " frames being shut together, holes pierced in *p* and *q*, " and a bellhanger's clip inserted in them, the whole is " complete and fit to place in the hive between other

" frames of comb, or to receive the combs cut from a " common frame. The nucleus hives in which the " Queens are hatched may be made to take one or two " dividing frames. One is preferable for the following " reasons: Firstly. A smaller number of Bees will be " required to keep up the needed temperature for " maturing the Queen at the least 70 degrees in the " smaller than the larger hives. They will all be " collected on the two combs, and by placing the Queen " cell somewhat between, they will be compelled *nolens* " *volens* to nurse it. Secondly. Only half the number " of dividing frames will be required in the apiary that " the larger hive would demand. Thirdly. Less combs " will be employed; and this, with Bee-keepers who " have not many stocks, or who have been fortunate " enough to lose none during the winter, is a matter of " considerable consequence. Fourthly. Nuclei always " dwindle, and only half as many young Bees will be " required to strengthen the smaller nucleus hive as the " larger would need."

These twin frames, when shut together, form one Woodbury frame, and if, when intending Queen-breeding, two or three of these complete twin frames are inserted into the middle of the hive from which it is desired to breed Queens, the reigning monarch will speedily stock them with eggs; and if she be then removed, her subjects will, after a few hours' delay, convert from four to twelve (or more) of the young larvæ into Queens. Should only a small number of young Queens be desired, and the Queen cells are sufficiently distributed amongst the twin frames, when they are sealed the frame may be divided, and every such divided frame containing the desired cell removed

to a nucleus hive with the cell facing inwards, and another frame of brood placed alongside it. It may happen that some of the small frames have on their combs several Queen cells; if left there, all but one will be sacrificed, but they may be utilized by cutting them out, and inserting them in other frames not fortunate enough to have Queen cells of their own. If the parent hive has not been furnished with twin nucleus frames, the combs alone may be divided and fitted into the small frames in the manner which will be found described under the head of "Transferring." It will then be seen that each full-sized Woodbury comb will completely furnish a nucleus hive, wanting only the Bees. It is, undoubtedly, an advantage that each comb in the nucleus should contain plenty of brood, because, as they hatch out, fewer Bees will be required to carry on the work of the miniature colony; and if it be found that the Bees dwindle too fast, and the brood has hatched out, change one of the empty combs for a fuller one, or place any quantity of young Bees, who have not flown, on the floor board in front of the nucleus, they will run in and fraternize at once.

Young Bees may be always told by their lighter colour, having a greyish look about them. When breeding Queens, it is not safe to leave a number of sealed cells together more than nine days after the first cell was formed, as, should an older larva than usual have been selected by the Bees for a Queen, it may hatch sooner than expected, when the remaining royal larvæ will be sacrificed. When the young Queen hatches, let her remain with the nucleus until she becomes fertile, when she may be made use of either to replace another Queen, or to build up a new stock.

The nucleus should be stocked with young Bees, if possible, as they are not likely to go back again to the hive of their birth, and will live longer. A goodly number should be given in order that the two combs may be well covered; to accomplish the stocking, search for combs having plenty of young Bees on them, then shake them in front of the nucleus hive, taking care to spread a paper or cloth from the entrance to the ground in such a manner as to prevent the Bees taking shelter *underneath* the hive; this may be accomplished by slightly raising the hive from its floor board, and putting the edge of the cloth beneath it. The Bees will then run in, and probably remain; but if next day it be found many have deserted, repeat the process until a sufficient population is procured.

The Bee-keeper who keeps himself familiar with the internal economy of his hives will often find numbers of Queen cells in swarming time; the first Queen who hatches, generally destroys the rest, but if Queens are wanted, the cells as sealed over may be transferred to nuclei, or to other hives, where a Queen is required. Care should be taken not to bruise the cell, as the contained pupa is very delicate, and it must not be allowed to become chilled; so the more quickly all operations can be completed the better. The cell should be cut out with a triangular piece of comb attached, and inserted, mouth downwards, in a similar aperture in the selected comb. Before removing Queen cells, it is as well to wait until they are nearly mature, which may be known by the cell having the wax removed from it by the Bees, so as to give it a brown appearance. *King's Bee-keepers' Manual* describes the following method of procedure pursued in America to form nuclei :—

"Form a nucleus from an Italian or other populous "stock, by blowing a few whiffs of smoke into the "entrance, and, opening the hive, select a frame of "comb containing capped brood, but especially plenty "of eggs and young larvæ. After looking this over "carefully, lest the old Queen be removed, place it, with "its adhering Bees, in the empty hive, and next to it "another comb containing honey, which will afford "protection to the brood and food for the Bees, as "many of the old Bees will return to the parent "stock; give the nucleus hive at least a quart of Bees, "and set it on a new stand, two or three rods distant. "Contract the entrance so that but one or two Bees "can pass at the same time, and set a feeder on the "frames or sponge, filled with sweetened water, will "supply their wants until the young Bees go to work in "their new location. In place of the combs removed "from the parent stock, set in empty frames with a "full one between. If the frames are put near the "centre the old will increase all the faster, as the "Queen will fill the new comb with eggs as fast as it "is built. The removal of the two frames stimulates "the Bees to great activity by giving them room to "work, and detaches just Bees enough to prevent "their clustering idly about the entrance. The nucleus "will construct Queen cells, and rear a Queen as well "as whole swarms. Besides, the Queen is easily found "among so few Bees. We now wait until the tenth or "eleventh day from the time the nucleus was formed "when we open it, and with a sharp thin-bladed pocket-"knife, cut out all the Queen cells *but one*, and use "them immediately; in forming other nuclei, by at-"taching one of them to a frame of comb, and Bees

"taken from an old stock as before described, and placed "in an empty hive. The beginner should remove but "one at a time, returning the frame from which it was "taken to its place in the hive, until the royal cell is "adjusted in its new location. When practicable, leave "about an inch square of comb attached to the cell, "and upon taking the comb or brood from the old stock "make an opening among the eggs and larvæ, where "the Bees will be sure to cluster upon it, and keep it "warm. If the first nucleus was formed from the only "Italian stock in the yard, and more Queen cells are "wanted, remove every Queen cell from it, and add "another comb of eggs, and brood from its parent stock. "But when no more Queen cells are needed, leave one "to hatch, and as by this time the brood will all be "capped over, the Bees will be liable to follow the "young Queen on her excursion to meet the Drones. "To prevent this, exchange one of the combs for one "containing eggs and young larvæ, when forming the "other nuclei. Young Queens will return, unless lost by "birds or other casualties, to which all Queens are "once exposed. Such loss is easily ascertained among "so few Bees, and we have only to insert another Queen "cell, adding a comb containing eggs and brood, and "repeat the trial."

Dathe, a German Bee-master describes the following patterns of nucleus hives, and methods of Queen rearing as practised in Hanover:—

"For Queen-rearing, small colonies only are required, "and, consequently, also only smaller hives. It is, however, "necessary that these should have moveable frames, as "the combs have very often to be examined. There are "various sizes of hives which may be thus described:—

"First. Queen hives with frames of the usual size; "these are called 'Half-hives,' and have the same depth "(front to rear) and height of the parent hives, so that "all the frames are interchangeable; but the width of "these hives are only half that of the latter, hence their "name. These are sometimes divided by a central "partition into two equal parts, which is carried out- "wardly beyond the entrance hole, thus forming a "kind of twin hive. These half-hives can be placed "singly or in stacks of six, one on the other; they serve "more particularly for hatching Queen cells and main- "tenance of Drones when they are not in existence in "other hives.

"Second. Queen hives with smaller frames, called "'Octave Hives.' These are boxes with very small "frames, only about 1-6th or 1-8th part of the usual "size; they are $4\frac{1}{2}$ inches deep (front to rear), and "only wide enough for three frames, and they are "constructed of three different heights, 7, $5\frac{3}{4}$, and $4\frac{1}{2}$ "inches. They can be placed singly, and by twos, or "fours, in any direction, and can also be put two or "four together into one larger box for shelter.

"Third. Queen hives only used for hatching ripe "Queen cells, called 'Sedez Boxes.' These are very "small, 3in. deep, 2in. wide, and 2in. high, and closed on "all sides with small glass windows, which are covered "with dark paper. No frame is contained in them as "the box itself is in reality a small frame. They are "used to put a piece of comb into, of the width and "height of the boxes, ready for the insertion of a ripe "Queen cell, for the mere purpose of hatching; a few "dozen Bees are placed in each, and they are stored in "any spare place in a hive; or, if the hive be populous,

"in a super, where the Bees can congregate about them. "As the contained Bees are imprisoned, having no hole "for egress or ingress, air apertures must be cut; and "it is necessary that a corner be taken off the piece of "comb, to enable the Bees to travel from one side to "the other."

Now the young Queen being safely hatched in the nucleus hive, the miniature colony may be left to itself to follow the ordinary course of Nature; and on an early fine day her majesty will leave the hive, and careering in the air, will probably meet with matrimonial success, and return properly impregnated to the hive she started from. If her return be seen, the success of her expedition may be known by her appearance, as she has attached to her the organs of the Drone; but if she should return unobserved, we must wait for results which, if all has gone well, will be the deposit of eggs in the Worker cells. Either of these facts being ascertained, the Queen is ready for disposal, where most desired. Drones seldom leave their hives except in fine weather; this accounts for the non-impregnation of Queens during unfavourable weather; at other times failure is uncommon.

LIGURIAN BEES AND THE METHODS OF LIGURIANIZING AN APIARY.

"The better brood, unlike the bastard crew,
Are marked with royal streaks of shining hue."—VIRGIL.

BOTH Aristotle and Virgil wrote of a Bee which answers to the Ligurian, or as it is sometimes styled "Italian" or "Alp" Bee, and even in their days it was called the better variety. The name "Ligurian" appears to have been given by Spinola, who described it in 1805. It has since been introduced into most Bee-keeping countries. The species is indigenous to the south of Europe, and has been cultivated in Italy in the same way as the common Honey Bee has been in the northern parts of Europe from time immemorial. It is the *Apis Ligustica* of the naturalist; and though so well known to exist and to have all the honey-producing properties of our own Honey Bee, with some other advantages besides, it seems remarkable that it should have remained so long uncultivated by the Apiarians of this country.

The merit of introducing this species is due to Mr. Woodbury, the eminent Devonshire Bee-keeper, who, having made the necessary preliminary inquiries, placed himself in communication with Mons. H. C. Hermann, of Tamin-by-Chur, in the Canton of Grison, Switzerland; and on the 19th of July, 1859, the Ligurian Bee was introduced to England.

In a pamphlet on the subject by M. Hermann, we have the following particulars of this insect:—

"The Yellow Italian Alp Bee is a mountain insect; "it is found between two mountain chains to the right "and left of Lombardy and the Rhætian Alps, com- "prising the whole territory of Tessins, Vetlin, and "South-Graubunden. It thrives up to the height of "4,500 feet above the level of the sea, and appears to "prefer the northern clime to the warmer, for in the "south of Italy it is not found. The farther one goes "from the Alps, the less handsome they are found "—as for example in Nice, until they are entirely lost "in lower Italy in the black species. We must, there- "fore, look for the original in Switzerland, and we can "call them with as much right *Apis Helvetica*, as the "Genoese call them *Apis Ligustica*. Some learned "men have called them Ligurian Bees, but that name "has neither historical nor geographical claim, and "not one Bee-cultivator of the whole district of the "Italian Alp Bee knows what kind of insects Ligurian "Bees are. The Alps are their native country; there- "fore they are called Yellow Alp Bee.

"The Italian Yellow Bee differs from the common "Black Bee; it has three light chrome yellow-coloured "abdominal bands, each 1-16th of an inch wide. The "Queen is lighter in colour, but otherwise not different "in appearance to Black Queens."

The Ligurian Queens are more prolific, their progeny swarm earlier and more frequently, and also work much harder, being abroad both earlier and later. It has been often said that they work on flowers inaccessible to the common Bee, as their tongues are longer; but, from careful microscopical measurement of a large

number, I can contradict this; the size of both Bees and tongues vary, like in the common Bees, but after measuring and averaging many, I found the length practically the same.

Ligurian Bees are now largely cultivated in Britain, and are generally preferred to the common Black Bee; and many Bee-keepers, taking advantage of the fact that the Ligurians and Blacks are both one species (although which is the variety and which the species is unknown to us), and having well proved the theory of Parthenogenesis, have successfully replaced their Black Queens with Ligurians, and so eventually succeeded in Liguriani zing their whole apiary. This may be accomplished in various ways; the best and simplest is to depose the whole of the reigning sovereigns, and elevate to their vacant thrones fertile Ligurians, which are now imported in considerable numbers at irregular intervals, and are generally bespoken on their arrival; for in the little boxes they arrive in they will not thrive long, and the casualties of the journey are sometimes serious. Supposing these have to be purchased, the expense will depend on the month in which the operation is to be performed. If the Bee-keeper determines to commence his season with the new Queens, they will cost in May or June from 12*s.* to 15*s.* each, but if he be content to wait till September, about half the money will suffice.

This is a considerable reduction from their value when first introduced, about fifteen years ago, which was something like two guineas. At the price now obtainable, they will amply repay their speculative purchaser, for there is no question the Ligurian variety is a far better worker and breeder than our old friends.

They may be seen sallying forth to work long before the true Britons, and still labour after their neighbours have sought their well-earned rest. The Queens are more prolific, probably because of the above; for whilst food comes into the hive, breeding will go on, and if supplies are stopped, so is egg-laying. The introduction of a Ligurian stock is a general source of benefit to the other Bees of the neighbourhood, for the natural law of "fresh blood" giving vigour holds good with Bees as with larger animals, and very quickly it will be found the progeny of many young Queens will show signs of love-making by the strangers.

The operation of exchanging the Queens may be performed in various ways dependent in a great measure on the form of hive in use; with frame hives ten or twelve minutes should afford ample time for the work, and the danger to the new sovereign is almost nil. With skeps or closed boxes more time is occupied, it being imperative that the Black Queen should be first captured; and, to effect this, it is generally necessary to drive-out the Bees until the Queen is discovered and safely removed. Sometimes she will elude the most educated and vigilant eye in spite of patience and assiduity; and it is never safe to introduce the new sovereign without being quite certain the old one is not in the hive. The mere fact of not finding her is not sufficient, and in the event of a battle royal it must not be forgotten the foreigner is tired, cowed, and enfeebled by her long journey and confinement, whilst her antagonist is in her accustomed vigour. Supposing the old Queen is surely removed, it would never do to introduce the new one to the tender mercies of the Workers without proper precautions being observed, for Bees are not noted for

hospitality to strangers, so she must be inclosed in a wire cage placed in the hive, and kept so imprisoned for at least twenty-four hours, when the excitement of the Bees at the loss of their old Queen will have passed away and the new one will generally be gladly accepted. It is advisable to sprinkle the Bees and Queen liberally with scented syrup both on the introduction and release. When the above time has elapsed, open the cage gently and let her majesty walk out. Watch carefully the Workers. If they take no notice of her or merely walk over, licking and feeding her, all is well and she may be safely left; but if she be seized by the legs and wings, and the Bees assemble tumultuously about her, beware! In a few minutes the Bees gather into a ball with the Queen in the midst, when regicide is meant. Take up the knot of Bees and drop them into a cup of water, which will effectually separate the cluster and hurt none; or pull off the Bees until the Queen is released, and immediately cage her again for another day's imprisonment, when the same process must be repeated with probably a better result. If a cluster is again formed, try the effect of worrying them about with some tobacco smoke for a few minutes, when most likely they will give up in disgust.

We must bear in mind that the great secret for the successful introduction of an alien Queen is to familiarize the Workers with her before giving them a chance of killing her, for though it is true, Bees, in the excitement of driving or swarming, may take a Queen then given and not discover an exchange has been made, and even when they have found themselves to be Queenless and all in consternation gladly

accept a new sovereign, the experiment is too dangerous to risk without precaution. It will be at once perceived how, by the proper management of nucleus hives, enough Queens may be bred from one Ligurian to supply any number of hives, the only difficulty being to obtain pure impregnation; and this where the Drones, either from one's own or neighbours' hives are English Bees, becomes difficult, and the chances are very much against it. Two or three plans may be adopted to secure this desirable result. Supposing one Ligurian stock is successfully established, Queens in nuclei should be raised; and if the raising of Drones can be prevented in the other hives by cutting out all Drone comb, or the Drones captured as they leave the hive, then supposing the Ligurian stock has plenty of Drones, there is a chance of the Queen's mating with one of those; but it is a poor chance should black Drones abound from neighbours' hives; however, crossed or not, a young Queen should be placed at the head of each stock; and next year (it having been abundantly proved that Drones are hatched from unimpregnated eggs) *all the Drones in the apiary will be pure Ligurians.* More Queens should then be reared, and (the chance of proper impregnation being now much increased) one should take the place of every Queen who is discovered to have been breeding mongrels. But even a mongrel stock is an improvement on the pure Blacks. Bees may be known to be mongrel if they are not all alike. Stocks of pure Ligurians vary in the brilliancy of their yellow bands, but all in the hive will be found to be alike, whilst the Bees of a crossed Queen will be found to vary, some with bright bands, others scarcely to be distinguished from Blacks. Plans have been practised

either to breed Drones and young Queens earlier or later in the year than those naturally raised, and success is often attendant. In the first case, a hive should be selected towards the middle or end of March—the two central combs removed and *Drone* comb substituted. The Queen will fill the cells and Drones be hatched in due course, by which time young Queens should be ready. If this be properly managed these Ligurians will be the only Drones about, and on the Queen's issuing they may probably be mated successfully; but the danger is the Drones and the Queens not issuing or meeting together; and if the Queen be not impregnated within three weeks of her birth she becomes a Drone-breeder. Of course if Queens and Drones be bred from selected Queens, in the autumn, after the natural bred Drones are killed, the same result may be obtained. Drones at this time are best obtained by depriving a hive, when full of Drones, of their Queen, when the former will be suffered to live; or putting at the head of a stock furnished with Drone comb an unimpregnated Queen who, of course, will breed Drones only. Mr. Cheshire suggests the following plan to increase the chances of pure impregnation: "The nucleus hive being complete "and its selected Queen cell inserted, place it as near "as possible to the stock containing the Drones which "is desired to mate with the maturing Queen. The "Apiarian's wishes in the matter will determine his "selection. If the Ligurian be mainly prized for its "beautiful markings, the choice will probably fall "differently from what it may be if high fertility "be chiefly sought. If the hive admit of it, and one "nucleus only is available, it may be placed upon

"the Drone containing stock, making the openings "of the two hives face opposite ways; the Queen "being duly hatched and the time for her flight "having arrived, he transfers the nucleus late in the "evening to a dark room or cupboard, having previously "closed the flight hole with perforated zinc; the next "afternoon being so far advanced that Drones are, for "the most part, quietly resting from their midday "wanderings, the Drone containing hive is opened and "thoroughly warmed, diluted honey is sprinkled over "Bees and frames, the cover is replaced, and a food "bottle containing the before mentioned Bee delicacy "placed upon it. The nucleus is now brought from its "hiding place and positioned as before, care being taken "that the sun shines as fully as possible into the flight "hole. Let the nucleus now receive, by lifting carefully "the cover, a gentle libation of warm Bee nectar, and "shortly, in all probability, the Queen will issue to be "joined by one of the Drones, which, in large numbers, "will now be careering in merry mood around the "excited stock. Should she fail to come forth, the "operation must be repeated on the succeeding day."

TRANSFERRING COMBS AND BEES TO FRAME HIVES.

A Bee-keeper would often use a frame hive, were it not for the fact that his Bees are at present domiciled in a skep, and he knows not how to remove them; and as this is one of the most important operations, requiring some exercise of skill and knowledge, I will endeavour to explain the method to be pursued.

A novice will find considerable difficulty in transferring the combs of a hive that are full of brood, as the young larvæ are extremely delicate and susceptible to cold, and, therefore, it is by far the easiest plan to allow the stock to swarm either naturally or artificially, and the brood to hatch out, which will all be accomplished to the last egg in twenty-one days after swarming, excepting, perhaps, a few drones; at this time (a day or two, more or less, will not matter) the combs will be empty and light and much easier to handle. Now let *all* the Bees be driven from their old home into an empty skep, which place on the old spot; then carry the denuded hive into a room or other place inaccessible to the Bees. An old skep is seldom of much value, and in this case with a strong knife cut it right in half between the two centre

combs. The object we have in view is to fill the frames of the new hive as far as we can with the combs from the skep, and in the absence of apparatus, which I will presently describe, lay the first frame down flat on a clean table, and having cut out one of the centre combs, if it be larger than the frame (as is usually the case with centre combs) merely cut the lower side straight, and reduce the height of the comb so as to fit the frame by cutting off as much of the honey cells at the top as may be requisite, and the same at the two ends, so that the comb shall fill the frame completely, and consist of all or nearly all Worker cells. If there be any portions of the fitted comb *prominently* thicker than the centre part, slice it off with the knife, endeavouring to arrange so that the foundations of the cells shall be equi-distant from both sides. If the comb was sufficiently large, it should now be found firmly fitted to the frame, and can be at once placed in the new hive as far as possible in the same order as the comb was when fixed in the skep. Some of the combs will now be found not large enough to fill the frames; if they be plentiful, cut them into rectangular pieces, and so fill the frame. The Bees will join all together, and they will soon make a good sound comb; but when combs are scarce, and we cannot afford to waste any, cut the top straight, and if the bottom bar be not reached, support the comb with a wooden lath under its bottom edge, under which pass two or more tapes, tying over the top bar against which the comb should thus be tightly pressed. If the vacancy between the lath and bottom bar be not much, the lath may be wedged up tightly by means of two or three old corks or like means, or light laths may be tacked

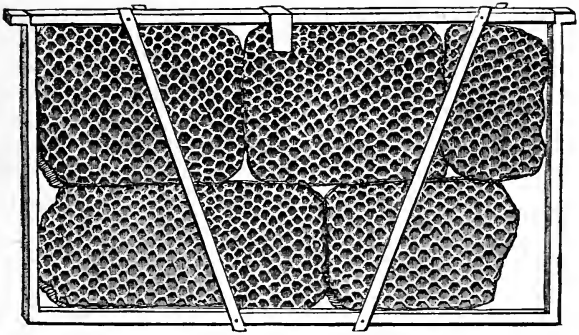


Fig. 43.

across as in engraving (Fig. 43). Should the combs not reach along the whole length of the top bar, it is as well to fasten on a strip of Worker comb as a guide for the Bees to continue, or they will probably build crooked.

Care should be taken to preserve as much Worker comb as possible, to pare the thick honey cells away until they are of the proper thickness, and to put the combs in the right way upwards, that is, as they were built. Very little Drone comb should be returned, and that placed towards the sides of the hive. All the parings of the combs, waste honey, &c., should be carefully collected into a feeding bottle, and given to the Bees on the top of the hive; they will re-store the honey, so that little or no waste will occur, and it will assist them in eleminating wax wherewith to fix and make good the combs, which in the summer will generally be found done in forty-eight hours; after which, the supports may be removed, being careful in replacing the frames not to damage the fragile new attachments.

Now to return to the fitting; as fast as the frames are fitted, replace them in the hive, and when all are in place, about which no time should be lost, return the Bees as if they were a new swarm—see "Natural Swarming."

If there be not enough combs to fill all the frames, guide combs should be attached to those empty to insure straight building; and in swarming time all spare combs should be utilized in this manner.

An apparatus which greatly facilitates this operation was exhibited by Mr. F. Cheshire at the Crystal Palace Show, which he calls a "Transferring-Board."

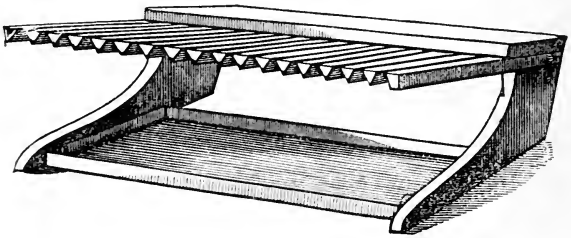


Fig. 44.

The judges thought its utility worthy of a special prize. It may thus be described: The board consists of sixteen wooden tongues about 10 inches long, fixed like the teeth of a comb; it has legs which, for packing, fold underneath, and a zinc pan to catch the dripping honey. Flat on the tongues is placed the comb to be transferred, and the frame is fitted on to it; a lath is then laid on its edge under the comb, and tapes passed between the tongues, and fastened at once on the top bar. The lath is not required if the frame be quite filled. The board can then be tilted up until perpen-

dicular, carrying the comb and frame with it, which latter is to be at once lifted out and placed where required. I have several times used this appliance, and have found it very handy.

REMOVING SUPERS FROM THE HIVES.

"But she, with such delicate skill,
Her pillage so fits for our use,
That the chemist in vain with his still
Would labour the like to produce."—COWPER.

A SUPER should have interposed between it and the crown board of the hive a floor board (or, as it is generally called, an adapting board) of its own to be removed with it; it may be severed from the attachments of the combs by a thin wire or string. When removed it will probably be thickly populated with Bees, who will be reluctant to leave; if a Bee trap be used, their riddance is easy (see chapter on "Bee Traps"), but in default of that appliance, some trouble will be found. If the combs be on bars or frames, remove them one at a time, and brush the Bees off; but if they be fixed as they would be in a glass, remove it, turn it up, and many Bees will fly home. It had better then be covered up for a short time secure from robbers, again turned up, and more will go; repeat this until clear, or if it be taken into a room the Bees will fly to the window, which may be afterwards opened to give them exit.

Should any breeding have taken place in the super, search must be made for the Queen; if she be found she must be returned at once to the hive.

ROBBING.

"HONESTY is the best policy," but Bees seem to think the contrary, and "might gives right," is a proverb more often acted upon by them. Should a hive become weak, and especially if Queenless, as soon as the state of affairs be discovered by a neighbouring strong family, a raid is organised. Poor Bees! gallantly do they defend their stores, and great the slaughter that ensues, but numerical strength is sure to conquer; when the assailed are fully assured that resistance is in vain, they act very wisely, and instead of fighting longer, turn to and help the invaders to carry off the stores, and in reward are received as new citizens in the free-booting hive. If a hive which is known to be weak be discovered in a state of unusual bustle and excitement, watch it narrowly; and if fighting be going on nearly close up the entrance for a few days, leaving room only for one or two Bees to pass at a time; a narrow door is more easily defended than a wide open gate. Should the assailants be very pertinacious, wet a piece of tow or moss with carbolic acid, and fasten it on the alighting board; the robbers will be too disgusted to pass, but the defenders will brave it. Fighting may often be ascribed to the Bee-keeper's carelessness in spilling honey or syrup round about a

weak stock, which being discovered and appropriated by stronger Bees, they soon seek for more plunder in the same locality. The Rev. Mr. Kleine says, robbers may be repelled by imparting to the hive some intensely powerful and unaccustomed odour. He effects this by placing in it in the evening a small portion of musk, and on the following morning the Bees, if they have a healthy Queen, will boldly meet their assailants. These are nonplussed by the unwonted odour; and if any of them enter the hive and carry off some of the coveted booty, on their return home, having a strange smell, they will be killed by their own household.

FEEDING.

THE means by which food may be administered to Bees is elsewhere considered, and I will now explain when, and in what quantity it should be given. At the time a swarm issues, the weather is generally fine; but it sometimes happens a change takes place, and the swarm having no stores, and not being able to gather any, of necessity suffers. Such a contingency happening, the prudent and merciful Bee-keeper will give food at once, not too fast, say half a pint of syrup per diem; if a superfluity be given, the swarm will occasionally construct Drone combs to store it in, which is not desirable. Bees, when they swarm, seem filled with an uncontrollable impulse to build combs; this is a necessity of their future existence, and it is of the utmost importance that the impulse should be fostered and encouraged. The Queen cannot, of course, lay an egg without a cell to put it in, and as she is capable at this time of laying 2,000 or 3,000 each day, the waste to their owners will be easily seen, should all these embryo Bees be lost. Old stocks in the spring have their stores at the lowest ebb; the winter's consumption has not been made good; and unless the prudent insects find food is coming into the hive, no great amount of breeding will take place. Of course the earlier Bees

breed, the sooner they will swarm or store in supers; and in a great measure breeding may be induced at the will of the Bee-master. As soon as the weather will allow in the spring, every stock should be examined, and if found deficient in food, it must be administered. In cold, damp weather, too much syrup is not good; there is no objection to sufficient being given for daily consumption, but the Bees must not have enough given to fill their combs, or the damp arising from it will very likely cause dysentry, and if over supplied they will be apt to store it in the centre combs, being the nearest, and these are all just which should be left for the Queen's use. Barley sugar is a very good food for such times, and may be given to the Bees either in a bottle, or put into the hive, not too much at a time, or it may liquify and form a trouble as well as waste. Barley sugar, superior to that bought at confectioners, may be made as follows, viz. :—

Break up three pounds of loaf sugar, place it in a saucepan or preserving pan, and pour half a pint of cold water upon it and half a wine-glass full of vinegar, these are all the ingredients required. Prepare a fire in a grate, the top bar of which will let down in a similar way to that in an ordinary kitchen grate, taking care, however, that at the commencement of the operation the bar is up in its place, and the grate full to the top with glowing cinders or wood embers, so that a great heat may be obtained without any flame. The saucepan containing the sugar place upon the fire and stir it without ceasing. In a few minutes it will begin to assume the character of dirty broth, which will have anything but a nice appearance, but presently a thick scum will rise and the mass will try to

boil over. As soon as this is observed, the saucepan should be removed from the fire until the ingredients have cooled a little, when it should be set on the grate again in such a way that only a small part of it is over the fire; the boiling will then go on on the exposed side; and, as the ebullition takes place, the scum will be forced to the side not over the fire, whence it may easily be removed with a spoon. Thus the saucepan is held in the left hand, the spoon in the right, and the saucepan being on the left-hand side of the grate, with its right side exposed to the action of the fire, the scum will retreat to the left or cooler side, and will be in the handiest position for removal, as will be evident in a few minutes to any one trying it. After a quarter of an hour of this treatment, the mixture will have become in a great degree clarified, when it should be removed from the fire, while the top bar of the grate is let down so as to permit of its nearer approach to a greater heat. Should there be any irregularity of the fire it should now be corrected, but flame should be prevented, as the mixture having parted with its water will be liable to take fire if brought into contact with flame. It will be well here to remark that so long as the scum remained on the syrup, there was a tendency in the whole to boil over, since the water evolved in the form of steam, while the boiling was going on accumulating in a body, would lift the scum above the saucepan to enable it to escape; but when the scum was *gone*, the water would be evolved in bubbles of steam, which would *crackle*, but not boil over, unless a very intense heat were applied. The duration of the boiling of the clarified syrup, before it becomes liquid barley sugar, will depend

upon the amount of heat, and the consequent evolution of the water, to which it is subjected; but trials may, from time to time, be made by dropping a little on some cold surfaces to see if it becomes brittle, and when that state is arrived at it is done. Pour it into a tin dish, set it in a dry, cool place until it becomes hard, and then by striking the tin on its underside, the whole of the barley sugar will be splintered into fragments, when it may be placed in bottles and corked up for use as required.

Those who wish for early swarms and strong stocks will do well to feed slowly in March or in April, even although the stock has plenty of stores; one of Mr. Cheshire's feeding stages will be found an admirable aid to effect this properly. The object aimed at should be to afford a *constant steady supply without a break;* if the stage be used, as much as the Bees can suck through two or three holes will be sufficient, this will be perhaps one-third or one-fourth of a pint daily; so long as this supply be kept up, so long will the Queen lay, and the Bees tend the young; *but* if the supply be stopped for a day or two, and nothing comes in of Nature's providing, the Bees will destroy all the young larvæ, and even those almost ready to emerge, should famine appear imminent. In May and June last (1874), when bad weather succeeded a few fine weeks, the Bees could be seen carrying out their nearly mature young in thousands. When feeding is continued during the day as well as night, take care the supply is well protected against robber Bees, or it will lead to fights and slaughter.

Bee-keepers often express astonishment that their Bees, after wintering all right, die in the spring; the

cause is easily explainable: the stock had enough honey to last the winter, but not sufficient to supply the large demand of spring when the young put in their claims on the commonwealth.

When a stock has become very weak and impoverished, the Bees often display such lassitude that they do not accept the proffered food; in this case they may be excited by pouring into and amongst the cluster half a cupful or more of the syrup made warm; they will then set to work cleaning one another, and gain strength and inclination to make use of the remainder. Bees in straw skeps may also be fed at other times by pouring syrup in a fine stream into the combs; this will run into the cells and be afterwards properly taken care of by the Bees; the quantity given must be regulated by the weather and other circumstances, bearing in mind the caution I have given as to dysentry.

A small swarm, which if left to itself would infallibly die, may be often built up into a moderately strong stock by slow and judicious feeding, such as I have described for spring stimulation. The regularity of a small supply will induce the Bees to build Worker comb, and as fast as built, the Queen will stock it with eggs. If too much food be given it will be a misfortune, the cells being filled with honey where should be brood. Autumn feeding should be on a totally different plan to that I have been writing of—then the one object is to get the Bees to store enough in their hives to last the winter. Towards the end of August every hive should be examined, and such as do not contain at least twenty pounds of honey should be fed until that weight be reached. The weather being warm, the syrup will

soon evaporate sufficiently, so the Bees may be supplied as fast as they can take it. A strong stock will have no difficulty in storing away a quart of syrup in twenty-four hours. If the hive be not fully supplied with combs, this liberality should not be exercised, or too much Drone comb will be made, which is not desirable; better by far first persuade the Bees, by slow feeding, to make the comb, and then give them the wherewith to fill it. It is a common practice to obtain Bees by means of driving, either by gift or purchase, from those who would otherwise destroy them in the autumn for the sake of their stores. These Bees, by slow feeding, may be induced to fill their hives with combs and honey, but the experiment is troublesome and costly, and those who have other stocks would find it better to join the poor castaways to their more fortunate sisters, which will benefit all parties. Such a beaten out stock of Bees would consume thirty to forty pounds of honey to bring them into a fit state to winter. Syrup, as a Bee food, may be made as follows, and the present low price of loaf sugar, which should alone be used (about 33*s*. per cwt.), is a great advantage to the Bee-keeper, as this article is undoubtedly the best for general feeding. If a strong syrup be made of it by boiling with water, the sugar will either recrystallize as the syrup cools, or subsequently, as the water evaporates. If it be used in this form it is liable to solidify, or, as the sugar baker calls it, grain, after it has been deposited in the cells by the Bees; should this happen, they will be unable to feed upon it. This may be effectually prevented by adding to the syrup while boiling a small quantity of vinegar. The amount of vinegar necessary varies with its strength; but about a

tablespoonful of that in general use will be sufficient for four pounds of sugar, which will make with two pints, or forty ounces of water, a syrup of the right consistency, and which should boil for ten minutes after the vinegar is added; twenty ounces of water measures a pint. Rather more water may be used early in the season, when the Bees are breeding rapidly, because they then need a thinner syrup to prepare food for their young than is required for store for winter consumption. After preparing this food, put a little of it upon a piece of window glass, when it should simply grow stiffer, without losing its transparency, as the water dries out of it. If crystals are formed, and it becomes white and opaque, it must be reboiled with a little more vinegar. Instead of vinegar, cream of tartar may be used, of which a quarter of an ounce must be added to four pounds of sugar. This food will at the present time cost about 2*s.* 8*d.* per fourteen pounds, or a little over 2*d.* per pound.

Honey is, of course, the most natural food to give to Bees, but sugar syrup answers equally well and is far less valuable; and, unless the source from which the honey comes is known to be pure, there is a danger of introducing with it "Foul-brood." Foreign honey is said to be very often contaminated by this plague. Those using frame hives, where the frames are interchangeable, will often be able so to arrange their combs as to save much trouble in feeding. Some hives have more honey than they require, therefore can part with a comb or two to their poorer neighbour, and thus the stores may be equalized.

POLLEN.

THERE is another food that Bees, when breeding, cannot do without, that is "Pollen" or "Bee Bread," which, with honey, forms the food of the larvæ. There is seldom any absolute necessity for the Bee-keeper to trouble about supplying this, the Bees generally having stored, or being able to gather, sufficient. But the Americans and Germans are in the habit of supplying a substitute for this in rye meal. Dzierzon, early in the spring, observed his Bees bringing home this substance from a neighbouring mill before they could procure a natural supply of pollen; and so, not losing the lesson, it became a common practice to supply the Bees early in the spring with this article. Shallow troughs are set in front of the apiaries, filled about 2 inches deep with finely ground unbolted rye meal; and Langstroth says: "Thousands of Bees, when the "weather is favourable, resort eagerly to them, and, "rolling themselves in the meal, return heavily laden "to their hives. In fine, mild weather, they labour at "this work with great industry, preparing the meal to "the *old* pollen stored in their combs—thus they breed "early, and rapidly recruit their numbers. The feeding "is continued until the blossoms furnishing a preferable "article, they cease to carry off the meal. The average "consumption of each colony is about two pounds." I have not heard that this pollen substitute has been much used in England; probably its advantages are not appreciated.

A contributor to the *British Bee Journal* has given an amusing account of a feast of rye meal provided to his Bees:—

"I obtained some rye flour or meal, and having "placed it in two shallow boxes near the hives, I "waited the result. The first day or two the Bees took "no notice of it, but soon a few with inquiring minds, "having made a minute inspection of the contents of "the boxes, communicated to the Bee community at "large, that in conjunction with the unusually early "supply of honey (syrup) this spring, pollen was to be "obtained in quantity close at hand. At it they went, "and much amusement they afforded me in watching "their actions. Some rolled in and took all they could "in that way, going home like veritable millers. Others "moulded up a small ball, and taking it between their "legs, conveyed it to the hives in that manner; in fact, "they seemed very much puzzled as to the best way of "availing themselves of such an unusual supply of their "farinaceous requirements. I fancied they seemed to "want something to stand upon to enable them to "gather it up easily, so I mixed some bran which I "happened to have at hand with the meal, and this "seemed quite to meet the exigencies of the case, for "now they were no longer puzzled how to act. Down "they went, again and again, each time repeating the "same operation, and the pellets on their legs each "time growing larger, until at length, fairly loaded, "away they flew, happy enough, with their new baby "food. For four or five days only did this last, for I "found them bringing in pollen of the orthodox yellow "tint, and, excepting early in the morning, my boxes "were neglected."

VENTILATION OF HIVES.

ANIMALS, from the smallest insect to lordly man, cannot live without air; and our little friend, the Bee, forms no exception to this rule. In the midst of summer, when the hive is populated to repletion, the heat becomes intense, and did not the Bees adopt some measures of prevention, the new and delicate combs would collapse and fall, as well as the health of the helpless larvæ suffer. Nature, therefore, has taught the Bees a remedy. If on a hot summer day the entrance of a hive be examined, a number of Bees will be there observed standing on the board with their wings in rapid vibratory motion, which carries in a strong current of fresh air, replacing the hot foul air driven out, and the number of "ventilators" is increased or diminished as occasion requires. By this means the atmosphere within is kept pure and wholesome, as was demonstrated by poor blind Huber. We are thus taught that Bees cannot bear close confinement which, if accidentally occurring, as it does sometimes by the snow or dead Bees blocking up the entrance, will, unless quickly obviated, cause dysentry and death. Apiarians who use hives with moveable tops can, in a great measure, regulate ventilation by leaving the top more or less open by means of a small

piece of perforated zinc placed over the feed hole. If rightly managed, this aid will set at liberty great numbers of Bees, who would otherwise be ventilating, to assist in the general work of the hive, and will often prevent the external clustering to which they are driven by the extreme heat, in order that the combs may not melt, or the young be stifled. The entrance of the hive, if properly constructed, should be capable of enlargement at need, and the Bee-master can, by this means, greatly assist in good ventilation by making the opening larger in summer and smaller in winter. A square of Bass-matting, carpet, or any such substance covering the frames under the crown board, will be found a very efficient ventilator in the summer—allowing the air just a small entrance and exit all round the hive. By cutting a central hole corresponding to the circular hole in the crown board, feeding need not be interfered with. The interference of the Bee-keeper in the matter of summer ventilation I do not consider of much moment; he can certainly assist his Bees, but if that assistance be not rendered, no great misfortune will necessarily follow. It is in winter that defective ventilation is frequently the cause of great calamity—no less than the death of the whole colony; and although I strongly advocate frame hives, I feel compelled to say this misfortune happens more frequently in those domiciles than in straw skeps; but this is no fault of the frames or their construction, but simply that the wood with which they are usually built retains the generated moisture, whilst the straw allows the greater part to filter through. This defect being admitted, I now show how it can be remedied; *en passant* I may say that frame hives can be and are

made equally well in straw as in wood, when that objection to them, of course, is done away with; but when we use wood, which is the more common and handy material, care must then be taken that proper ventilation is provided. Much has been written on this subject, but I think the evil has been greatly magnified. When the Bees are thickly clustered together for the winter they do not hybernate like many other animals, but are all lively and require food, in the consumption of which moisture is evolved in the form of vapour—this, if it cannot escape, naturally condenses into water, keeping the hive cold and damp, and the temperature low, obliging the Bees to eat yet more to keep up the necessary heat, and thus the evil is increased.

Upon a due appreciation of this subject, much of the success of Bee-keepers depends. If we consider Bees as we should human beings, we should not err much in the treatment and construction of their domiciles. With proper ventilation, Langstroth says: "No amount of cold that we ever have will injure "Bees;" and as he records the temperature of January, 1857, at 30 degrees below zero, which is never reached in England, I do not think we need fear. We all know a cold dry winter is more healthy than a mild wet one, even though the temperature of the latter should be many degrees higher; and a large airy bedroom, with window open, is preferable to a small close one with sand-bags and appliances to keep the cold out. Langstroth cites a case where twenty hives were in a row, one suspended 20 inches from the ground, without a bottom board, the others in the usual condition for wintering. The whole got very

wet; the nineteen died, and the one survived, having been able to get rid of the moisture. One of our most successful Apiarians mentioned to me that a hive which gave him a super of seventy-six pounds weight, in 1874, was wintered without a crown board, but covered with an empty super, and, as the result showed, with advantage to the Bees.

On making an examination of my stocks early in February, this present year (1875), I found one hive, a part of whose moveable crown board had slipped aside, exposing several square inches of the top freely to the air, but, fortunately, not to the rain. This stock was then by far the strongest of many, and had a fair show of larvæ growing up to Bee-hood.

Notwithstanding these facts, I do not think it advisable to winter Bees in such a spartan manner, for the colder they are the more they must eat, and, in a long winter, their stores would become exhausted, perhaps, before the frost had disappeared, when it would be almost impossible to feed them with success. A wooden crown board tightly fastened to the hive's top keeps the cold out *and the wet in*, and some means must be adopted to obviate this. When the hive is a simple box, with the combs built from the top, a loose pad should be laid on the feed hole. Mr. C. N. Abbott, the editor of the *British Bee Journal*, is a great advocate for the abolition of the crown board, and says in his journal: "*The Quilt* "properly applied is of all crown covers for hives the "very best for winter use, because it permits the "escape of all noxious vapours from the hive, as soon "as they are generated. The quilt arrangement "comprises a piece of carpet or other material of

"hard texture, with a hole in the centre for feeding "purposes, two or three thicknesses of felt, flannel, or "other porous materials, each also having a hole in "its centre of similar size as that on the carpet, a "piece of perforated zinc or vulcanite as a feeding "stage, a pad like a kettle-holder to lay upon the "vulcanite, and a folded sack, blanket, or rug laid "upon the whole; after which, the roof may be put on, "and should be fastened to prevent it blowing off. "We have had the quilt arrangement in use during "the whole of the past season, we have not now a "single bar-frame hive without it, and we never "intend to use a crown board again. During the "whole of our experience with this 'new invention,' "we have not had one article of the 'bedding' "attacked by moth, nor during the whole period has "the slightest inconvenience arisen through using "them.

"If *closely* covered, the whole arrangement will "become 'sopping-wet,' simply because the vapours "*cannot escape;* but this only proves its value when "properly disposed, as it shows that the vapours "would escape *through* it if permitted to do so."

Mr. Abbott's experience is great, and his opinion is entitled to much weight, but my limited observation during one winter with six hives so covered is opposed to his. I having found, in most cases, the quilt, or rather bed, wet and mouldy. In this experience I am joined by others, although I am bound to say evidence on the other side is equally strong. Whatever quilt mat or crown board is used, it is, of course, absolutely necessary that the hive and its covering be protected from rain and snow. The Americans use mats made

of sewn straw, according to their record, with great satisfaction. Mr. F. R. Jackson recommends a most inexpensive quilt of dried bracken in paper or linen case, passed through a mangle to flatten it. Possibly a combination, say one square of carpet, mat, and crown board, would make a better covering than any we have yet tried.

STINGS.

The fear of being stung deters many people from keeping Bees who otherwise would gladly avail themselves of such an instructive and profitable occupation, and to some persons the fear is well-founded; for, although the hardened Bee-keeper may treat with contempt the alarm as puerile, the sting of a Bee will often produce a painful and distressing temporary effect. As a satisfaction to those who, in spite of the dreaded little weapons, intend to become practical Bee-masters, I may give them the satisfaction of knowing that they will soon get inured, and mind them not at all. Many persons imagine on seeing a man handling Bees with impunity that he is never stung. This is an error; the Bees do sting him, although not so often as they would a timid stranger; but his blood is inoculated, and the poison has become innoxious. My son, a lad of sixteen, up to last spring had not meddled with Bees; then, becoming often my assistant, he soon had to pay the usual penalty, which was at first very severe. Great swelling and inflammation, accompanied with pain, and often an irritating rash would appear all over his body. The effect of every successive sting became less and less, until before the autumn closed, beyond a few minutes' irritation, there

was no effect. Mr. G. Walker, of Wimbledon, has recorded an experiment he made on himself to try how long, and how many stings, it would require to get inoculated. He gives the following as the *modus operandi* and result, viz:—

"I went to one of my hives, caught a Bee, placed "it on my wrist, and allowed it to sting me, taking "care that I received the largest amount of poison by "preventing it from going away at once; then I let "the poison-bag work, which it does for some time "after being separated from the Bee. The first day I "only stung myself twice. A Bee sting has always "had a very bad and injurious effect on me, inasmuch "as it has always caused a great amount of swelling "and of pain; in fact, once when stung on my ear, "the part became so painful and swollen that I hardly "got any sleep the following night, and it was three "days before I recovered. The first few stings I got "during this experiment had the usual effect; the "whole of my fore-arm was affected with a cutaneous "erysipelas, and there was disorder of the muscular "nerves, accompanied with heat, redness, swelling and "pain. This attack lasted till Tuesday, and on "Wednesday (October 7th) I was so far recovered "that, following the same plan, I stung myself three "times more also on the wrist. The attack of "erysipelas this time was not nearly so severe; but, as "before, I felt a stinging sensation as far up as my "shoulder, and I noticed that a lymphatic gland "behind my ear had increased considerably in size, "the poison being taken up by the lymphatic system. "On Saturday (October 10th) I again treated myself "to three stings, and the pain was considerably less,

" though the swelling was still extensive. At the end " of the next week (October 17th) I had had eighteen " stings; then I stung myself seven times more during " the next week, and I reached the number of thirty- " two on October 31st; the course of the experiment " having lasted very nearly four weeks. After the " twentieth sting there was very little swelling or pain, " only a slight itching sensation, with a small amount " of inflammation in the immediate neighbourhood of " the part stung, which did not spread further; and I " stung myself on November 8th, without its having " any effect on me."

Bees, when properly handled, seem in a great measure to know their masters. A nervous, fussy man, who attempts to disarrange them or their works will most certainly be attacked, whilst an adept in Bee management, who will do what he has to do, calm, steady, and without fear, will mostly escape scot free. In removing frames with their attendant Bees, if care be taken not to jar them, or in any way to irritate the Bees unnecessarily, they scarcely seem to object at all. It is true that, like in our human hive, tempers vary, and some cantankerous, spiteful little fellow may make a dash at any part of us that is unprotected. If a person be attacked by Bees, no attempt should be made to retaliate; the assailed party should quickly retreat to the protection of a building or shady place, or, if none be near, lie down with his face to the ground. An angry Bee will seldom follow into the shade if the sun be shining. Violent winds seem often to make the Bees very angry, by blowing them about; but, as a rule, Bees do not volunteer an attack without cause. Langstroth, amongst his Bee-keepers' axioms, says:

"Bees gorged with honey never volunteer an attack. "Bees may always be made peaceable by inducing "them to accept of liquid sweets. Bees, when "frightened by smoke or by drumming on their hives, "fill themselves with honey, and lose all disposition to "sting unless they are hurt. Bees dislike any quick "movement about their hives, especially any motion "which *jars* their combs."

Many devices in the shape of Bee dresses, some very ingenious, have been resorted to in order to protect the wearer against being stung; but, as in many other things, the simplest is oftimes best, and nothing more is requisite than a veil and gloves. An economical and very good veil is made of coarse black leno, costing fourpence per yard, made into a bottomless bag, 27 inches by 24 inches. In one end let be run half a yard of elastic, not too strong, which will complete the veil for use, as in figure 45, when on buttoning the coat up all is secure. The veil may be made at a cost of about sevenpence, and a duplicate or two kept handy for the use of friends, when inspecting one's apiary, becomes very useful. For the hands, there is nothing better than good soft macintosh gloves, lined with some textile fabric, such as are used by photographers; but these require the addition of gauntlets (which may be made of calico or silk) to cover 2 or

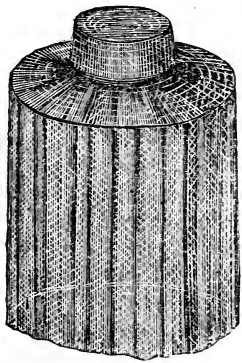


Fig. 45.

3 inches of the coat cuffs, held in place by elastic run into their upper edge. Where the India-rubber gloves are not procurable, stout woollen or leather may be used, but are not so effectual.

Thus equipped, the aspirant to Bee honours may bid defiance to his angry little friends, and in time confidence will be mutually established and, possibly, the gloves presented to a more unpractised hand; but even with the most experienced I should advise that the veil be kept in constant use, for accidents will happen, and stings about the eyes are never pleasant to any one. The Queen, although provided with a sting, never uses it, except in combat with another Queen; and it is scarcely necessary to say that Drones have no sting at all. Having been stung, the next consideration comes how to cure it, or at least reduce the effect to a minimum of discomfort. Many things are given as remedies, but I have no faith in any, except a good soaking in warm water in the manner most convenient. If the hands are stung, lay them in a basin of hot water, the longer time the better; if the face or other part, foment or poultice. When stung, remove the sting quickly, then, if possible, warm the pipe of a small key and press it over the puncture, a little drop of poison will, probably, appear, which remove; then apply a single drop of liquor potassæ, sal volatile, or chloroform, or rub well with sweet oil; either of these remedies will sometimes give relief, but they are neither specifics.

REMOVING BEES.

Hives with Bees in them travelling for six hours or more, should always be carried mouth upwards, except frame hives where the crown board can be removed, and perforated zinc substituted. On a short journey, if the hive be not removed from the floor board, it should be securely tied or nailed there, and perforated zinc be fixed before the entrance, and over the feed hole at top. Swarms and stocks may be trusted for a few hours, covered with cheese cloth or open towelling, but the Bees will knaw through this if the journey be one of days. Newly made combs will not stand much shaking, and these should only travel under the supervision of some careful persons; for should the combs be shaken down, great destruction of Bees would ensue, and the owner would have considerable trouble in rectifying the mishap. When frame hives are sent away, two strips of wood, with pieces nailed to them to go between the frames to keep them apart, should be fastened over and under the frames. When Bees are to be removed by hand, they ride easily and safely on a light hand barrow, which may be made of a couple of light poles, crossed by a few thick sticks.

PASTURAGE FOR BEES.

"Thou cheerful Bee! come, freely come,
And travel round my woodbine bower;
Delight me with thy wand'ring hum,
And rouse me from my musing hour.
Oh! try no more those tedious fields,
My honied treasures all are thine;
Come taste the sweets my garden yields,
The bud, the blossom, all are thine."—SMYTH.

WITH the exception of an occasional gathering from honey-dew (to be presently explained), Bees gather the whole of their honey from flowers, and, consequently, where there are no flowers they cannot thrive; but the term flowers must be taken in a broader sense than meaning such as we cultivate for garden ornaments or home decoration. The inconspicuous blossoms of many trees, the wee modest wild flower, scarcely noticed by passers by, furnish abundant pasturage for Bees. Many persons who have lived in the country all their lives are scarcely aware that our noblest forest trees have flowers at all, but from the brave old oak and the wide spreading beech, Bees gather many a pound of honey. An avenue of limes or sycamores, a field of beans or white clover, forms a very El-dorado for the busy Bees, their pleasant hum on the snowy hawthorn, or the sweet smelling sallow (palm as it is commonly called), is very noticeable when Nature is awakening from the gloomy sleep of winter, and our thoughts and feelings are glad with the prospect of

returning summer. Where large heaths abound, the Bees have a second harvest, and it is a common practice in such localities for Bee-keepers to send their hives to the moors for about two months, the trouble and cost being amply repaid by the immense weight of honey brought home which the common heather yields freely during August and September. In Scotland, and on the Continent, cartloads of hives may be seen travelling to and from the heather. Often on the spot they are looked after by some resident cottager, who receives a gratuity of about 1*s.* per hive from the proprietors of the stocks. In the south of England this practice is not pursued, although I do not see why it should not be in many places, there being miles of heather equally available as in Scotland. On the Nile there are Bee barges which travel only at night, stopping in the daytime at any place that affords abundant pasturage for the Bees; and we read in *Pliny* that this was likewise the practice in Italy in his time. "As soon," says he, "as the spring food for Bees "has failed in the valleys near our towns, the hives of "Bees are put into boats and carried up against the "stream of the river in the night, in search of better "pasture; the Bees go out in the morning in quest of "provisions, and return regularly to their hives in the "boats with the stores they have collected; this method "is continued till the sinking of the boats to a certain "depth in the water shows that the hives are sufficiently "full, and they are then carried back to their former "homes, where their honey is taken out of them." And this is still the practice of the Italians who live near the banks of the Po, the river which Pliny instanced particularly in the above quoted passage.

It was the advice of Celsus that after the vernal pastures were consumed, the Bees should be transported to places abounding with autumnal flowers, as was done by conveying the Bees from Achosia to Attica, from Eubœa, and the Cyclad Islands to Scyrus, and also in Sicily where they were brought to Hybla from other parts of the Island.

What portion of our fertile land does not afford sustenance for Bees? Mr. Alfred Neighbour in his work, *The Apiary*, devotes a chapter to "Bee-keeping in London." Could we ever imagine a more unpromising field for honey gathering—London! foggy, smoky London! But think a moment; London has parks, squares, gardens; and each of these has trees, flowers, and shrubs. What matters if the flowers be dirty, their nectaries secrete the coveted sweet, and the natural filter of the Bees will clarify it better than any artificial one could do. Only last year, a lady living in Kensington, told me she kept Bees there; they throve well, and had furnished her with a super of fourteen pounds weight! It has been asserted that Bees will fly five or six miles for honey, if a supply nearer home be not obtainable; they may, but such an extreme labour would not allow the stock to thrive. Too much time and muscular strength would be consumed in making the journey. The great danger to Bees in town is their liability to be tempted into shops, such as grocers, confectioners, &c., where they get bewildered, fly to the window, and, in vain, attempt to penetrate the glass, they die. Breweries are also fatal places, the sweet wort attracting numbers who perish by drowning.

Most Bee-keepers have a garden, and in it can be grown many flowers pleasing to the eye, grateful to the

nose, and useful to the Bees. Mignonette, borage, honeysuckle, hyacinth, crocus, laurustinus, lavender, lily, primrose, and many other flowers are visited by Bees, and may all be cultivated with advantage; the arable fields supply buckwheat, beans, mustard, clover, and lucerne, which all give an abundant supply of honey; and, if we follow America's example, we should sow, when possible, special Bee flowers. Borage has th reputation of being the best of all Bee flowers. It blossoms continually from June till November, and is frequented by Bees, even in moist weather. The honey from it is of superior quality, and an acre would support a large number of stocks.

Dwellers in the country cannot fail to have observed occasionally that the leaves of the trees and shrubs have a gummy appearance, and are sticky to the touch. If a leaf so covered be put to the tongue it will taste sweet; this is honey-dew, and is a secretion of some species of aphides ejected from their abdomen in little squirting streams. This substance the Bees readily gather, and when it is abundant, make large additions to their stores. It is generally most plentiful in June or July, and is chiefly found on forest and fruit trees, although often on low growing bushes; at the season of its greatest abundance the pleasant hum of the Bees engaged on it is very audible.

DISEASES OF BEES.

Bees have not many diseases to trouble them, but the few they have are oftimes very fatal; indeed one, which is known under the name of foul-brood, has been justly termed the Bee Plague; this fatal complaint is far more common than is generally supposed, and to it many a Bee-keeper who has found his apiary unproductive for years, with stocks dwindling in spite of all care, may with truth attribute his ill-success. Much has been written and said on foul-brood, but up to the present time it is not thoroughly understood, nor effective means known either for its prevention or cure. It is not of modern origin, for Aristotle described it more than two thousand years ago. I may briefly say that foul-brood is the name given to a disease which causes the larvæ of the Bees to die and putrify in their cells, where they turn to a disgusting foul smelling, semi-liquid mass, impossible for the Workers to remove, in which condition the air of the hive becomes necessarily impure, poisoning the unfortunate inhabitants.

The cause of foul-brood has been much debated, many observers being of opinion that the disease is simply the rotting of brood which had become chilled; but the opinion seems to be gaining ground that, like typhus and scarlet fever in our human hive, it is solely produced from germs of a fungus, millions of which are

floating in the atmosphere, and which, when finding an appropriate habitat, germinate and produce the disease; probably the foulness of dead larvæ provides this condition, and the fungi spores there find the essential condition, as in like manner typhus finds it in squalor, and dirt.

Dr. Schönfeld of Germany, has made a variety of experiments, which tend to prove the correctness of this theory, and I extract the following from a paper, translated by Mr. J. S. Wood:—

"Dr. Dzierzon proposed, by the wish of the editor "(of *Bienen-zeitung*), at the last (Vandreforsamlingen) "Exhibition at Saltsborg, the following question:— "'What is to be looked upon as decided relative to foul- "'brood, both as regards theory and practice, and what "'remains now undecided?' But, although he laid all "his views and his name's influence in the balance in "favour of the correctness of the Preusziske theory, he "must still acknowledge that the incontestable proof "was wanting, as at the conclusion of his answer he "declared, 'If also the theory brought forward by Dr. "'Preusz should prove correct, yea, even if it is the "'most probable, so is yet the question—cause, the sick- "'ness's real nature—even now enveloped in obscurity.' "Thus we stand in relation to the problem which I "previously stated:—

"Firstly. It must incontrovertibly be proved that "the spores of the fungus leave the dried-up foul-brood, "and they must, inasmuch as they float in the air, be "able to be caught.

"Secondly. It must next be shown that such fungus "spores, that are caught in the atmosphere, when placed "on healthy larvæ, can grow and increase to an

"uncountable number, until at last they kill the brood, "and so prove themselves the cause of the sickness.

"Although the problem appeared difficult, I went "even confidently to the work. I wrote immediately "to Herr Locher, in Sigmaringen, and asked him for a "little foul-brood. The 18th of June I received, "enclosed in a letter, so much as I could form into a "ball about the size of a pea. The substance was very "dark, nearly black, moist, and tenacious, and its odour "was exceedingly disagreeable. A careful examination "under the microscope proved the presence of fungus "of the same form as Micrococcus. Had I, after "having solved my problem, began first to show that "the spores could escape through the fly-holes (entrances) "of hives containing foul-brood, it would have been "necessary for me (in order to have obtained such a "hive) to dissolve the infectious substance in water, and "therewith sprinkle a comb containing healthy brood. "It is most probable that such a proceeding would have "failed, as the Bees would most surely have cast out "the dead larvæ and pupæ before the artificially pro-"duced sickness had had time to develop itself fully, "and infect the whole hive. In every case there would "have gone a much longer time by that means before I "had arrived at the result. I had not, however, in the "meantime the opportunity, as I already wished to "discuss my experiment at Halle. I, therefore, im-"mediately made the experiment to catch the spores "that were escaping, and were floating in the atmo-"sphere, from the infected substance that had been sent "me, and thereafter use them for infecting healthy brood. "For this purpose I constructed the following appara-"tus: On a smooth-planed board I placed a bell-glass,

"in the top of which was a round hole; in this I fixed "a glass tube 2 feet long; there was also fixed a "similar glass tube in the board. In the top of the "uppermost tube was fixed a plug of cotton-wool, as "also in the under end of the bottom tube, and the "wool was not pressed tight, but so that the air could "circulate freely through both tubes. The foul-brood "substance that I had received from Herr Locher, was "now placed under the bell-glass on the 21st of June, "and left to dry slowly. If, then, the assertion that the "spores escaped in the air when the substance was dry "was correct, then it was only necessary for me now and "then to place the apparatus by the window in my "study, and expose it to the full influence of the sun-"beams, as if the air in the bell-glass, by the power of "the sunbeams, was warmed up to 40°, it must, by "a well-known physical law, escape through the upper-"most tube, while the cooler air from the floor of the "study must enter the bell-glass through the bottom "tube, and at the same time it was quite as certain that "therewithal the spores of the fungus, that were carried "by the upward current of air, would be caught in the "wool above.

"On the 5th July, on which day the substance was "quite dry, until the end of the month, I got four plugs "of wool, each of which had served as the top plug for "about eight days; besides these I had two pads of "wool, each of an area of about 4 square inches, "which I had placed inside at the top of the bell-"glass.

"Had the spores from the substance really been "escaping? and had the wool caught them as they "were coming out into the world? All rested on the

"answering of these questions; and examination gave "the following results:—

"(1.) When quite a small portion of the wool was "washed in distilled water, and thereafter a drop of "this water placed under a microscope, it showed "a considerable quantity of fungus Micrococcus.

"(2.) If a plug of wool, as large as a pin's head, "was laid dry on a piece of glass thereafter moistened "with distilled water, and placed under the microscope, "the Micrococcus could be seen partly in the water, "and partly adhering to the threads of wool.

"(3.) If the wool was examined dry it was difficult "to see the Micrococcus, and it could only be seen by aid "of the strongest lens, and through three objectives.

"(4.) Of gun-cotton, of which I had two plugs, "which were prepared with water as sub. 1 and 2, "Micrococci were to be seen in still greater quantities "than in the ordinary wool, probably because the one "is finer and better suited to retain the spores.

"Thus, by a practical method, I have solved the "first part of my problem; and it is without a doubt "proved, though in an unequal degree, that the spores "of the fungus from the dried-up matter escape, and "are borne away by the atmosphere.

"Therefore there cannot be the slightest doubt of "the fact, that in consequence of the Bees ventilating "so strongly as they so often do, that the spores must "be driven out of a severely infected hive in very large "quantities.

"When V. Molitor-Mühlfeldt, in order to refute this "assumption, declares that there is no circulation of air "in a Bee-hive, but that, owing to the motionless air, "the spores must sink down, and not pass from cell to

"cell, it sounds almost as if he had no idea of ventila-
"tion being caused by the Bees, and as if he had not
"read paragraph 111 of Von Berlepsch's *Der Biene.*
"When Günther has succeeded in working a small
"windmill of paper by placing it at the entrance of a
"hive containing a strong stock, then it is evident that
"the circulation of air produced in the hive by the
"Bees must, in proportion, be a much stronger
"hurricane for these light spores than any such hurri-
"cane Von Molitor-Mühlfeldt has witnessed on the
"earth. And when the same opponent declares on the
"whole that the atmosphere cannot be the bearer of
"the infection, so has that invalid assertion been so
"thoroughly refuted by Dr. Ulde, of Halle, that I will
"not waste a word on the subject.

"It is quite certain that it is not over all, and at all
"times, that the atmosphere will contain such a
"quantity of seed-germs; and Dr. Preusz goes too far
"when he declares that the atmosphere is *everywhere*
"*loaded* with these germs. If such was the case, foul-
"brood infection would appear in every district where
"there are Bee-keepers; but there can be shown many
"districts where this disease is quite unknown; as
"in my district, up to the present time, it has not
"appeared.

"I certainly succeeded in producing a whole comb of
"dead rotten, and stinking brood; but although I ex-
"perimented with this comb in the most various ways,
"placed it at the fly-hole at the open door, and exposed
"to the sun's warmth and the atmospheric currents
"about my pavilion, I, after examination, found no
"more fungus than Fischer, who never had anything
"to do with foul-brood.

"*Where there is no fungus present, there can never* "*arise infectious foul-brood.*

"Herewith we have approached nearer to the "solution of the second part of my problem.

"It next requires to show and afterwards to prove "that pure fungus collected from the atmosphere by "means of the cotton wool, has the power to kill larvæ, "and by so doing cause foul-brood. To do this, I "took, on the 30th of July, a comb with brood from a "first swarm, brushed off all the Bees, and covered "about one hundred larvæ with wool, which was made "fast by means of some thread. The comb was hardly "replaced again before the Bees attacked the wool, "and commenced casting it out in small pieces. On "examination of the comb on the 1st of August, it "showed that all the larvæ that had been covered with "the wool were cleared away by the Bees. Three larvæ "above the previously covered cells died shortly after "the Bees had sealed the cells which they were in. "The cell-covers were sunk, and the well-known small "hole was in the centre.

"After this, about one hundred other larvæ were "covered with wool; but again, as also a third time, "the larvæ and wool were torn out. I had nearly lost my "patience, and I had only now two plugs and one of the "squares left, which should be used for other experiments.

"I now, rather anxiously, for a fourth time, covered "a brood-comb, and this time, fortunately, the Bees "let most of the brood remain in the cells. After an "interval of four days, seven larvæ died. An instan- "taneous and conscientious examination, by aid of the "microscope, revealed the presence in their bodies of "immense numbers of Micrococci.

"Unfortunately, I was obliged now, on the 12th of "August, to defer my experiments, as I could not "postpone for a longer time a Bath tour on which I "should have started at the beginning of the month. "I forgot now to slide in a wire netting to prevent "those larvæ that remained being torn out by the "Bees, but on my arrival at home from the Baths I "found all in the best order.

"Still the fact that Micrococcus possesses an enor- "mous power of infection, and that it also attaches "itself to perfectly healthy brood until it kills them, "cannot longer be denied. As incomplete (which I "myself acknowledge) as the above proof turned out, "owing to the scantiness of material that I had at my "disposal, and the haste with which I was compelled "to operate, as strikingly and as unrefutably have I "succeeded by another process to prove it.

"As I at once saw beforehand that under the cir- "cumstances before mentioned, and the well-known "strong propensity of every strong hive of Bees to "remove as quickly as possible every sickly or dead "larva from the hive, it would be extremely difficult "to arrive at a complete and satisfactory result, so the "idea occurred to me to try the experiment of infec- "tion on the larvæ of other insects, which it would "be possible to observe without obstruction.

"As specially adapted for the purpose of this ex- "periment, it occurred to me that the larvæ of the "blow-fly would be the best, as these larvæ especially "possess an extraordinary vitality, that, notwith- "standing its voraciousness, it suffers hunger and "thirst, and in defiance of its nudity, can withstand "cold and heat most astonishingly; and besides the

"above, this insect resembles the Bee in its develop-
"ment, insomuch as it is as larva fourteen days,
"and it is as pupa about the same length of time.
"I could, without difficulty, procure and nourish these
"larvæ, and, what at that time was of most importance,
"I could take them with me to Johannisbath, and
"there comfortably observe them under the ordeal.

"I, therefore, on the 11th of August, laid a juicy
"piece of meat in the window, and a fly of metallic
"lustre, desirous of laying, soon deposited a heap of
"eggs on it. The next day about one hundred were
"hatched, and these grew with their well-known
"rapidity. The second day of my stay at Johannis-
"bath, to where, of course, besides these larvæ, I
"brought my microscope, some of the wool that
"contained the fungus, and also a few bell-glasses,
"under which latter I placed three separate sets of
"larvæ.

"The first and second had each ten, and the third
"the remaining larvæ. The larvæ under the first
"bell-glass on the same day, together with the meat
"which was their resort, were covered with wool. Six
"days after this the larvæ attained their normal size,
"and this without my being able to detect the slightest
"unhealthiness; on the same ten larvæ, under the
"same bell-glass, and on the top of the wool, I laid a
"fresh piece of meat, which, together with the wool,
"was well saturated and smeared with the excrement
"of the larvæ.

"Two days afterwards, seven of the larvæ were
"dead; some lay on their backs, others on their sides,
"but all were stretched out. The others lived and
"transformed after one, two, or three days' interval.

"A very careful microscopical examination the next "day of a dead larva showed that the whole surface of "its body was covered with Micrococci. I might wash "any portion of the larvæ and examine the water; I "might place the minutest piece of skin under the "objective and then moisten it, but always the same "result—Micrococci in innumerable numbers.

"As the remaining six larvæ soon decomposed, three "of them were dried on a piece of wadding so that "they could at a later date be used for experiments of "the same kind. Again, two were examined while "decomposing, and were found full of uncountable "Micrococci; and these last were spread on a piece of "meat and given as food to the ten larvæ in the "second bell-glass, which, up to this time, had not "shown signs of transformation. While we for the "present leave these ten unfortunate victims to their "fate, let us turn to the three pupæ, which, to all "appearance, fortunately have transformed, and whose "cocoons gradually get of a darker colour.

"Our first closer examination convinced us that they "were dead, as the cocoons here and there were sunken "in. Two of them that I cut out of the middle in the "direction of the length revealed such large quantities "of Micrococci fungi, that they, without a doubt, must "be acknowledged as the cause of their death.

"The third pupa, like the three before mentioned "larvæ, was reserved for future experiments.

"When I to the above add the ten larvæ from the "second bell-glass died before transformation, after a "few days' interval, being the result of having eaten "their fungus—containing sisters—that one larvæ that "I examined before its death already contained an

"enormous amount of fungi, and that all the others "after death proved to be full of fungi inwardly—more "especially in the intestines—while the larvæ in the "third glass transformed and came into existence as "flies, that I for many days bent over the microscope, "and had examined more than a hundred pieces; so "there can be no longer doubt of the fact that Micro-"coccus also infects perfectly healthy larvæ, and in the "end kills them.

"This result, willingly and without opposition, will "be accepted by the scientific, as there is nothing to "find therein that is opposed to experience or research.

"Herr Molitor Mühlfeldt rightly enough declares in "answer to my earlier articles, that no fungus-spores "can take root on the undamaged skin of healthy "animals, because the main principle—the suitable "underlayer—is only found when the animal is un-"healthy, or when about and unnoticeably has already "begun to decompose or dissolve; and this assertion "does not allow of scientific proof. And even if it were "correct, Dr. Preusz's theory is by no means refuted "thereby, or even threatened, as in reality every larva "that is seized by infection, finds itself in an extremely "sickly state, which may be traced to another cause.

"In general, the larva dies soon after the cell is "closed, and before it envelops itself as a pupa; during "the time that the larva changes itself to a pupa; not "alone the skin of the larva decomposes, but the larva, "certainly as the result of the natural metamorphosis, "finds itself in a sickly condition, and is to every "deadly attack peculiarly and specially adapted for "infection.

"We could, therefore, if we might allow Mühlfeldt's

"assertion a little attention, very easily say at the "sickening time of preparation for transformation, and "during transformation, the dying and decomposing "skin of the larva is the very best and most suitable "condition for the support of the fungus' growth so "that it multiplies at a rapid rate, and kills the larva "before transformation is at an end. Therefore, since "Dr. Preusz and Vogel, at Saltsborg, have given the "decided assurance that there are always found Micro-"cocci in foul-brood, and since I have practically proved "that healthy brood can be infected by Micrococci, so "can there no longer be doubt that where foul-brood "appears as an epidemic, there the infection is produced "and carried to effect by Micrococcus."

As an example of the destructive effects of this disease, I may cite the case of Dzierzon, the great German Bee-master, who in 1848 had this plague break out in his apiary with such virulence that he lost more than 500 stocks, only ten having escaped the malady. About ten years ago, a friend of mine who had twenty stocks, complained of them not being profitable, and I purchased the whole of him, and removed them to my garden. Alas! they were foul-broody, and I lost them all, and my original stocks in addition, as well as having two or three years of trouble and vexation.

Having now shown as far as we know the cause and effect, we have to seek a prevention and remedy. To cure an infected larva is, of course, out of the question, but to banish the disease from the hive is not so hopeless a case. In the first place, we should be careful that when using frame hives, the larvæ, which are very delicate, do not get chilled, for if they do and

die, then is created just the nidus requisite for the Micrococcus to flourish.

Whatever the cause of foul-brood, I now proceed to say how its presence may be known. If the apiary has been long unproductive, the Bees showing no energy or increase in their numbers, but, on the contrary, dwindling, *suspect foul-brood;* if extensively present, the combs will give out a bad odour like stinking animal matter, as indeed it is, and on examining the combs they will be found here and there black on the surface, with the cells having their caps somewhat concave with minute perforations; on removal of the caps the cells will be found to contain a foul smelling sticky semi-liquid coffee-coloured mass, which may be drawn out into threads like heated glue; the dead larvæ may also be found in all lesser stages of decomposition. Other cells will be found in which the liquid has dried, leaving at the bottom a mass containing the highly infectious fungus spores experimented with by Dr. Schönberg. Should the Micrococcus theory be correct, it will easily be imagined how every comb, Bee, and drop of honey in a foul-brood hive, becomes a centre of infection, spreading the disease far and near. If we at any time discover in the combs dead and rotting larvæ, excise the whole comb, or at any rate such portions as contain the foul cells. If the disease has not made much progress, it may be thus stopped, but the combs should receive a thorough examination frequently, to see if any more work for the knife appear. It will be perceived from Dr. Schönberg's experiment that the disease in its wet state is not contagious, although this is denied by some eminent Apiarians. Supposing, however, it is found that the

combs are in a bad state of disease, half measures will not do; there remains nothing but total destruction of the combs and honey, as well as the hives, if they are not valuable; straw hives should on no account be kept, and wooden hives, floor boards, &c., must be thoroughly disinfected by boiling or painting with carbolic acid or other disinfectant. The destruction as advised should be by burning, for if any piece of comb, &c., is left about, and be visited by a Bee, she carries home, perhaps, the germ of further trouble. The Bees may be saved thus: Let them be driven, or by other means taken out of the hive and confined in a straw skep with plenty of ventilation for two days, the act of driving will have induced every Bee to fill herself with honey from her old home; this, if allowed to be deposited in a new hive, would probably communicate the disease to the new combs, but by keeping the Bees confined for the time mentioned, all the honey will be consumed, and the risk of infection considerably lessened. After the quarantine has expired, transfer the Bees again to a clean hive; if they carried infection away from home they will probably leave it in the temporary hive, which, to be on the safe side, should be also destroyed.

Honey that is found in an infected hive should on no account be given to other Bees, and as it comes from an atmosphere of putridity, is not fit for human consumption; so is much better consigned to the flames with the combs, &c. Foul-brood is often introduced into a hive by feeding the Bees on foreign honey, which is not seldom infected with it.

One cause of the dwindling of a foul-broody stock is the constant reduction of the number of breeding

cells, for when a larva dies it is simply left to rot in its cell, which, of course, becomes useless, and the number of these cells may be so increased that the poor Queen cannot find sufficient for her eggs.

Dysentry.—This is another disease, which is sometimes very destructive to Bees, and in some phases runs very close to foul-brood; many Bee-keepers yet maintaining they are one and the same thing. There is no doubt, however, how dysentry is often caused; improper or too liquid food, cold, damp, and confinement will all produce the malady. Bees, it is well-known, are cleanly animals, and they will not, except under the most urgent circumstances, void their excrement within the hive. On the sudden appearance of a warm, sunny day, after perhaps a long series of inclement ones, how eagerly do the Bees fly abroad, and relieve whilst in the air their distended bowels! Conspicuous places round about their homes may be seen in all directions, spotted with their *rejectamenta*. When quietly clustering during the winter months Bees require to relieve themselves but seldom; but if they are by unnatural disturbance roused into a state of excitement, with their accustomed impetuosity they distend their honey bags by rifling their stores, and if unfavourable weather succeed, and they cannot fly out, dysentry is very likely engendered. The same effect may be produced by a cold damp hive, whether caused by atmospheric moisture from without, or by the imprudent stowage of a large quantity of watery food, perhaps given to them in mistaken kindness by their would-be benefactors. Dysentry is a disease of the Bees, sometimes extending to the larvæ. Foul-brood never extends to the Bees. If a hive be discovered in

this unfortunate condition, with still living inmates, the remedy is to remove all dead, give dry floor board, and, if a frame hive, transfer all Bees and combs to a clean dry hive. Should there be a large quantity of unsealed food it had better be removed by the extractor or otherwise, and the Bees, if necessary, fed with small quantities of honey or barley sugar; then, if the population be not too much reduced, we may hope to save the remainder.

Deaths from chilled brood and starvation cannot be attributed to disease, but rather accident; and I need scarcely say if mortality should be found to occur from either of these causes, the dead should be immediately removed lest disease should be engendered.

ENEMIES OF BEES.

"The titmouse and the 'pecker's' hungry brood,
And progne, with her bosom stained in blood.
These rob the trading citizens, and bear
The trembling captives thro' the liquid air."—VIRGIL.

In England the enemies of Bees are but few, if we leave out of the question their inhuman masters of the fire and brimstone school. Wax moths, although very destructive in America, make no headway in England; that is to say, in hives containing living Bees, although where empty combs are carelessly stowed away, they will, probably, be wholly destroyed. There are two species of moths which commit these depredations; one, the largest, *Galleria Mellonella*, is comparatively rare here, although commonly imported in the larvæ state with Ligurian Bees; the other, *Achroia Grisella*, is very common, and where combs are left about unprotected, its larvæ will most likely soon be too apparent. The Apiarian who pays proper attention to his stocks will not need to fear the wax moths. The death's-head hawk moth (*Acherontia Atropos*) is commonly cited as a robber of Bee hives, but in England it is sufficiently rare to be unnoticeable in our apiaries. On the Continent of Europe a small insect, known as the Bee-louse, *Braula Cœca*, often infects the Bees to a considerable extent, as many as a hundred being sometimes found on a single Bee, and as the insect is nearly as large as a small flea, the poor Bee, when thus

loaded, must find her life a burthen, as each louse lives by sucking the Bee; the young are said to be produced in the pupa state. I have found this pest several times on imported Ligurians; but the climate of England does not, fortunately, appear to suit them, for they have soon disappeared.

Wasps often become very troublesome; they do not hesitate to enter any hive to which they can gain admission. A strong stock can generally defend their entrance successfully, but woe betide the unfortunate weak colony; there the wasps run riot at their will, and will often completely rifle the hive of all its honied sweets. These marauders should be trapped in narrow-necked bottles of sweetened beer, which they will eagerly enter and get drowned therein; the Bees are seldom thus caught. Every wasp nest in the neighbourhood should be sought for and destroyed; and in the spring, when only the Queens are in existence, it must be remembered that every wasp then caught prevents the establishment of a nest.

Insectivorous birds are sometimes very troublesome, foremost of which stand the blue tit (*Parus Cæruleus*) and the great tit (*Parus Major*). These birds, in the winter time, when other insects are scarce, find an abundant supply from the Bee hives. It is said they will stand at the doorway of the hives, stamp, and await the unlucky Bee who seeks to know the business of the visitor; certain it is, that I have seen a rail, a few feet in front of my hives, studded with Bee stings in hundreds, torn from the unfortunate victims, whose plump and welcome bodies have formed the dinner of the tits, who apparently reject the small portion which might prove to them a discomfort. The fronts of the

hives may be fenced with a piece of wire netting to outwit these unwelcome visitors.

Mice, sometimes, will take up their winter quarters within a hive, feasting on the stores as occasion arises. When perceived they should be captured and destroyed.

COMBS.

"Galleries of Art, and Schools of Industry."

Combs, as everyone knows, are built by the Bees of wax, which is a natural secretion of the builders and appears in fine scales between their abdominal rings; it is eliminated from honey, possibly assisted by a simultaneous consumption of Bee bread. It was formerly believed that Bees secreted wax from pollen only, and a writer in an old edition of the *Encyclopædia Britannica* describes how it is done and the way it is disgorged up from the stomach to be worked up into combs; all of which we now know to be wrong, from the much greater facilities for observation we enjoy.

After a hard day's work in honey gathering the Bees do not rest, but employ the night in comb building; this work being then chiefly carried on, and on such days when the weather forbids out-door employment; thus no time is lost, even if they be confined several days. If the combs of a hive are examined, the cells will be found to be hexagonal—of several sizes—those for Drones and Workers never vary, the first are about 17 to the linear inch, the latter 27. As well as being used for breeding, these cells are brought into requisition for honey storing indiscriminately if occasion arises; there are also honey cells proper, generally of elongated Drone construction, sometimes very deep, in supers even 2 or 3 inches—these honey cells in the main hive are usually found at the top

and sides of combs, and on the outer combs more than on the central ones which form the brood nest. Queen cells, which are only present occasionally, if formed of the Bees' own accord, will be mostly found on the margin of the combs; if the Queen-rearing is forced, they are more often in the centre. These cells are, when fully formed, of an elongated egg shape, 1 inch long by 1-3rd of an inch in diameter; and, contrary to the other cells, which open sideways, these always open at the bottom, that is, mouth downwards. The number of Queens that the stock has reared may commonly be known by the bases of the old Queen cells left; they appear much after the shape of the acorn cup. Cells, where the young Queen has been destroyed by the reigning monarch, are usually quite cleared away by the Workers.

In the manufacture of one pound of comb, the Bees will consume sixteen to twenty-four pounds of honey; therefore, to save the Bees trouble and ourselves honey, old combs should, so long as they are clean and wholesome, be utilized to the utmost. Frame hives and the honey extractor will give every facility for this, and it will be found true economy to furnish all frames with combs whenever possible, and a straw skep full of combs, whose late inhabitants have died or deserted, will furnish for a swarm such a start as will send them far ahead of all competitors not so fortunate. In making use of old combs we are enabled to keep under the production of superfluous Drones, for, if Worker comb be given, Workers will be bred; and when we wish for Drones, all we have to do is to supply the Queen with Drone cells.

No old comb should at any time be used which has

about it the slightest suspicion of foul-brood—better far melt it down or burn it than introduce this malady into the apiary. All the whitest of the combs, particularly if of Drone construction, should be reserved for furnishing supers with decoys, without which, the Bees are often reluctant to work there. For breeding purposes, the colour of the comb is of little import, it will last good four or five years. Strips for guide combs are best made of the old and tough combs, and are as readily accepted by the Bees. The value of one pound of wax is about 2*s.* 6*d.*, that of twenty pounds of honey 20*s.*; therefore, by melting down one pound of clean Worker combs, the Bee-master loses 17*s.* 6*d.*! Why should not this lesson be borne in mind?

The process of comb building is thus described by Huber. (I may here say that in his time it was thought there were two kinds of Workers, whom he styles Wax Makers and Nurses; the fact is, there is but one kind; but the newly-born Workers, for some time after birth, confine their work to nursing and comb building, and not until afterwards do they issue from the hive to gather honey) :—

"The Wax Makers, having taken a due portion of "honey or sugar, from either of which wax can be "elaborated, suspend themselves to each other, the "claws of the fore-legs of the lowermost being attached "to those of the hind pair of the uppermost, and form "themselves into a cluster, the exterior layer of which "looks like a kind of curtain. This cluster consists of "a series of festoons or garlands, which cross each other "in all directions, and in which most of the Bees turn "their back upon the observer; the curtain has no

"other motion than what it receives from the interior "layers, the fluctuations of which are communicated to "it. All this time the Nurse Bees preserve their wonted "activity and pursue their usual employments. The "Wax Makers remain immovable for about twenty-"four hours, during which period the formation of wax "takes place; and thin laminæ of this material may be "generally perceived under their abdomen. One of "these Bees is now seen to detach itself from one of "the central garlands of the cluster, to make a way "amongst its companions to the middle of the vault or "top of the hive, and by turning itself round to form a "kind of void, in which it can move itself freely. It "then suspends itself to the centre of the space which "it has cleared, the diameter of which is about an inch; "it next seizes one of the laminæ of wax with a pincer "formed by the posterior metatarsus and tibia, and "drawing it from beneath the abdominal segment, one "of the anterior legs takes it with its claws and carries "it to the mouth. This leg holds the lamina with its "claws vertically, the tongue rolled up serving for a "support, and by elevating or depressing it at will, "causes the whole of its circumference to be exposed "to the action of the mandibles, so that the margin is "soon gnawed into pieces, which drop as they are "detached into the double cavity, bordered with hairs, "of the mandibles. These fragments, pressed by others "newly separated, fall on one side of the mouth and "issue from it in the form of a very narrow riband.

"They are then presented to the tongue, which im-"pregnates them with a frothy liquor like a bouilli. "During this operation the tongue assumes all sorts of "forms: sometimes it is flattened like a spatula, then

"like a trowel, which applies itself to the riband of "wax; at other times it resembles a pencil terminating "in a point. After having moistened the whole of the "riband, the tongue pushes it so as to make it re-enter "the mandibles, but in an opposite direction, where it "is worked up anew. The liquor mixed with the wax "communicates to it a whiteness and opacity which it "had not before; and the object of this mixture of "bouilli, which did not escape the observation of "Reaumur, is, doubtless, to give it that ductility and "tenacity which it possesses in its perfect state.

"The Foundress Bee, the name which this first "beginner of a comb deserves, next applies these pre- "pared parcels of wax against the vault of the hive, "disposing them with the point of her mandibles in the "direction which she wishes them to take; and she "continues these manœuvres until she has employed "the whole lamina that she had separated from her "body when she takes a second proceeding in the same "manner. She gives herself no care to compress the "molecules of wax which she has heaped together; she "is satisfied if they adhere to each other. At length "she leaves her work and is lost in the crowd of her "companions. Another succeeds and resumes the "employment; then a third; all follow the same plan "of placing their little masses; and if any, by chance, "gives them a contrary direction, another coming "removes them to their proper place. The result of "all these operations is a mass or little wall of wax, "with uneven surfaces, five or six lines long, two lines "high, and half a line thick, which descends perpen- "dicularly below the vault of the hive. In this first "work is no angle nor any trace of the figure of the

"cells. It is a simple partition in a right line without "any inflection.

"The Wax Makers having thus laid a foundation of "a comb, are succeeded by the Nurse Bees, which are "alone competent to model and perfect the work.

"The former are the labourers, who convey the "stone and mortar; the latter, the masons, who work "them up into the form which the intended structure "requires. One of the Nurse Bees now places itself "horizontally on the vault of the hive, its head corre- "sponding to the centre of the mass or wall which the "Wax Makers have left, and which is to form the "partition of the comb into two opposite assemblages "of cells; and, with its mandibles rapidly moving its "head, it moulds in that side of the wall, a cavity "which is to form the base of one of the cells to the "diameter of which it is equal. When it has worked "some minutes it departs, and another takes its place, "deepening the cavity, heightening its lateral margins "by heaping up the wax to right and left by means of "its teeth and forefeet, and giving them a more upright "form; more than twenty Bees successively employ "themselves in this work. When arrived at a certain "point, other Bees begin on the yet untouched and "opposite side of the mass, and, commencing the bottom "of two cells, are in turn relieved by others. While "still engaged in this labour, the Wax Makers return, "and add to the mass, augmenting its extent in every "way, the Nurse Bees again continuing their opera- "tions. After having worked the bottom of the cells "of the first row into their proper forms, they polish "them, and give them their finish, while others begin "the outline of a new series.

"The cells themselves, or prisms, which result from "the reunion and meeting of the sides, are next con- "structed. These are engrafted on the borders of the "cavities hollowed in the mass; the Bees begin them "by making the contour of the bottoms, which at first "is unequal, of equal height; thus all the margins of "the cells offer an uniformly level surface from their "first origin, and until they have acquired their proper "length. The sides are heightened in an order "analogous to that which the insects follow in finishing "the bottoms of the cells; and the length of these "tubes is so perfectly proportioned that there is no "observable inequality between them. It is to be "remarked that though the general form of the cells "is hexagonal, that of those first begun is pentagonal, "the side next the top of the hive, and by which the "comb is attached, being much broader than the rest, "whence the comb is more strongly united to the hive, "than if these cells were of the ordinary shape. It, of "course, follows that the base of these cells, instead of "being formed like those of the hexagonal cells, of "three rhomboids, consist of one rhomboid and two "trapeziums.

"The form of a new comb is lenticular, its thickness "always diminishing towards the edges. This grada- "tion is constantly observable, whilst it keeps enlarging "in circumference; but as soon as the Bees get sufficient "space to lengthen it, it begins to lose this form and to "assume parallel surfaces; it has then received the shape "which it will always preserve.

"The Bees appear to give the proper forms to the "bottoms of the cells, by means of their antennæ, "which extraordinary organs they seem to employ as

"directors, by which their other instruments are "instructed to execute a very complete work. They do "not remove a single particle of wax until the antennæ "have explored the surface that is to be sculptured. "By the use of these organs, which are so flexible and "so readily applied to all parts, however delicate, that "they can perform the functions of compasses in "measuring very minute objects, they can work in "the dark, and raise those wonderful combs, the first "production of insects.

"Every part of the work appears a natural conse- "quence of that which precedes it, so that chance has "no share in the admirable results witnessed. The "Bees cannot depart from their prescribed route, except "in consequence of particular circumstances, which "alter the basis of their labour. The original mass of "wax is never augmented, but by an uniform quantity; "and what is most astonishing, this augmentation is "made by the Wax Makers, who are the depositories of "the primary matter, and possess not the art of sculp- "turing the cells.

"The Bees never begin two masses for combs at the "same time; but scarcely are some rows of cells con- "structed in the first, when two other masses, one of "each side of it, are established at equal distances from "it, and parallel to it, and then again two more "exterior to these. The combs are always enlarged "and lengthened in a progression, proportioned to the "priority of their origin, the middle comb being con- "stantly advanced beyond the two adjoining ones by "some rows of cells, and they beyond those that are "exterior to them. Was it permitted to these insects "to lay the foundation of all their combs at the same

"time, they could not be placed conveniently or parallel "to each other. So with respect to the cells, the first "cavity determines the place of all that succeed it.

"A large number of Bees work at the same time on "the same comb; but they are not moved to it by a "simultaneous, but by a successive impulse. A single "Bee begins every partial operation, and many others "in succession add their efforts to hers, each appearing "to act individually in a direction impressed either by "the Workers who have preceded it, or by the con- "dition in which it finds the work. The whole popu- "lation of Wax Makers is in a state of the most complete "inaction, till one Bee goes forth to lay the foundations "of the first comb. Immediately others second her "intentions, adding to the height and length of the "mass; and when they cease to act, a Bee, if the term "may be used, of another profession, one of the Nurse "Bees, goes to form the draft of the first cell in which "she is succeeded by others."

"So work the Honey Bees,
Creatures that by a rule in Nature, teach
The art of order to a peopled kingdom."—SHAKESPEARE.

DRAINING HONEY FROM THE COMBS.

WHERE the honey comb is pure and white, as is usual with combs built in supers, it is customary to send it to table whole and without bruising; but when the combs come from the main hive, where breeding has been going on, the honey must be drained and stored as clean and pure as possible. Having a mass of such combs before us, it becomes advisable to sort them into qualities, all such as have Bee-bread or larvæ being put aside, then slice them transversely through the cells, and put them in a hair sieve or fine linen bag, leave them so two or three days, turning them over occasionally, and nearly all the honey will run out; do not press or crush them and impurities will be avoided. The strained honey should then be nicely skimmed, and the skimmings put with the strained and waste combs to make metheglin of; or should this not be desired, give the whole to the Bees in a bottle or super over the feeding hole and they will carry down every particle of honey for their own subsistence or their master's necessities, should he determine to appropriate their stores. The filtering and refining will be done far better by the Bees than is possible by any human means. The strained honey should be poured into glass jars until they are *quite full*, tightly tied over. Those honey-

combs it is desired to reserve for table use should be neatly wrapped up in writing paper and carefully put aside, the honey within the cells will be found clear and limpid many months afterwards. The pieces of combs, if any, containing brood should be stacked the same way upwards as they were built, and inserted in a small glass or super; this, if placed over the feeding hole of another hive, will be taken possession of by the Bees from below, who will tend and rear the young whose lives may be thus preserved.

Bees will sometimes gather honey from objectionable plants, of which laurel and ivy form examples; such honey, although not harmful to the Bees, may be intensely disagreeable to us. Where such is observed prudence dictates that it should be left for the Bees' own consumption.

THE USES OF HONEY AND HOW TO MAKE USE OF IT.

HONEY—luscious honey—is generally a treat to our little ones for their breakfast, tea, or supper, in place of butter, and nice and wholesome it is too, as well as an agreeable change; but, unlike bread and butter, they soon tire of it, so it is only as a treat that it can be consumed in that way. To the buyer of ten pounds or twenty pounds this does not matter, but where we keep our own Bees, and our little friends supply us with the delicious commodity by the hundredweight, then an important question arises—How to dispose of our honey? Naturally the answer comes—Sell it. Very good, but first a customer must be found, and we do not all like to turn hawkers without a license; so now I suggest we should take a lesson from our neighbours of the Continent, who have many ways of using honey to please all palates. Almost contemporaneous with our Crystal Palace Exhibition were held at Paris and Copenhagen gatherings of a similar character, and, in addition to most of the exhibits that were shown here, appeared a long list of eatables and drinkables made wholly or partly with honey, which would be very welcome on the tables of our own land. Taking the Paris catalogue, I see here were shown

honey bread, spiced bread, fruits preserved in honey, jellies, sweetmeats, cakes, bonbons, pastiles, and chocolates; whilst for eau de vie we need not leave old England, seeing it is to be made both from honey and wax! Then we have hydromel or metheglin, champagne, red and white wines, liqueurs, fruit syrups, vinegar, and fruit cordials. There is a pretty list of delicacies for our housewives to exercise their ingenuity and skill upon!

Regretfully, I say I have no knowledge how to make most of these good things. Metheglin is generally made from the waste comb, after all the available honey has been run out, and I extract an excellent recipe furnished by Mr. J. Oliver to the *Journal of Horticulture*. I may state that I have tasted the liqueur made according to this recipe and can vouch for its being super-excellent: "When the comb has been drained of its honey, put "it in a large vessel, then pour in sufficient lukewarm "water to swim it nicely. Let it stand two days, stir "occasionally, then strain it. Skim the scum from "the liquor carefully, filter the sediment through a "flannel bag, then boil one hour. To three gallons: "—two pounds raisins, one ounce of ground ginger, "and seven or eight laurel leaves, then cool. Add a "little brewer's yeast, let it stand part of a day, then "barrel it, leaving the barrel open for two or three "days; bung it up, and let it remain untouched "for six months, then bottle it. I daresay some who "try their hands at making this honey drink will be "anxious to taste before the expiration of the six "months, but the longer it is kept the better it will "be. If an egg will float on the liquor it will be "about the right strength.

"Metheglin may, of course, be made from run "honey; but by soaking the combs in water we utilize "the honey which would otherwise be lost. A little "lump sugar put in each bottle will make it as fine as "brandy."

Honey vinegar is made as follows: "Put half a "pound of honey to a quart of water, boiling hot; "mix well, and expose to the greatest heat of the sun "without closing the vessel containing it, but "sufficiently so to keep out insects. In about six "weeks this liquor becomes acid and changes to "strong vinegar, and of *excellent* quality. The broken "combs, after being drained, may be put in as much "water as will float them, and well washed. The "linens, also, and sieves which have been used for "draining honey, may be rinsed in the same water, "and with this make the vinegar; first boil and scum "it before mixing it with the honey."

To clarify honey: Melt the honey in a vessel standing in boiling water, strain, while hot, through flannel previously moistened with warm water.

Honey is prescribed by the medical council of Great Britain for use in the following pharmaceutical preparations, viz.: Confection of pepper; confection of scammony; confection of turpentine, honey and borax; oxymel of squills, and simple oxymel.

Honey Cakes.—Mix a quart of strained honey with half a pound of powdered white sugar, half a pound of fresh butter and the juice of two oranges or lemons. Warm these ingredients slightly, just enough to soften the butter, and then stir the mixture very hard, adding

a grated nutmeg. Mix in gradually two pounds or less of sifted flour, make it into a dough just stiff enough to roll out easily, and beat it well all over with a rolling pin; then roll it out into a large sheet half an inch thick, cut it into round cakes with the top of a tumbler dipped frequently in flour, lay them in shallow tin pans slightly buttered, and bake them.

PREPARATION OF WAX.

HAVING employed the Bees to extract every particle of honey from the combs, put the latter in a clean boiler with some soft water; simmer over a clear fire until they are melted; pour a quart or so into a canvas bag, wide at the top and tapering downwards like a jelly bag; hold this over a tub of cold water; the boiling liquor will immediately pass away, leaving the liquefied wax and the dross in the bag; have ready a piece of smooth board, of such a length that one end may rest at the bottom of the tub and the other end at its top; upon this inclined plane lay your reeking bag, but not so as to touch the cold water; then, by compressing the bag with any convenient roller, the wax will ooze through and run down the board into the cold water, on the surface of which it will set in thin flakes; empty the dross out of the bag and replenish it with the boiling wax, and proceed as before until all has been pressed. When finished, collect the wax from the surface of the cold water, put it into a clean saucepan with very little water, melt it carefully over a slow fire, skim off the dross as it rises, then pour it into moulds, or shapes, and place them where they will cool slowly. The wax may be rendered still more pure by a second melting and moulding, and may be bleached by running it into thin ribands and exposing these to the bleaching action of a grass plat for several days and nights, taking care the sun is not allowed to melt them.

PROPOLIS.

"And with their stores of gather'd glue contrive
To stop the vents and crannies of their hive,
Not birdlime, or Idean pitch, produce
A more tenacious mass of clammy juice."—VIRGIL.

THIS is a resinous substance which the Bees obtain from various trees, and it is applied by them to a variety of useful purposes. It is, I believe, the only one of their stores, if we except Bee bread, that man has not found it useful to deprive them of. With propolis the Bees fill up every undesirable crevice about their hive, fix the latter to the floor board, and, often to the annoyance of the users of bar-frame hives, cement the moveable (?) crown board so tightly to the top that it becomes a fixture and occasions considerable trouble to loosen it. Everything else in the hive that is not tightly fixed will soon be put into that condition with propolis. But these are not the only uses to which Bees put propolis. Should a slug or other animal make its unwelcome appearance within the hive, its death is soon compassed; but how about its burial? No number of Bees can move its dead carcass, which, left to itself, would putrify and poison the atmosphere. These Bees have a remedy in propolis; with it they will construct an air, water and odour-proof tomb, and actually build the corpse up in propolis where it may harmlessly decay. Reason and Instinct! Who shall presume to say where the line is drawn?

PROFIT.

When a man thinks of starting Bee-keeping, he generally has an eye to profit, and the question is commonly asked: "How much honey shall I get per hive?" Now this question is more easily asked than answered, the result being dependent on so many circumstances over some of which we have no control. Moreover, many think they have only to obtain a hive of Bees, set it down in the garden, and giving it no further attention, profit must, as a matter of course, ensue. This is a great mistake, the farmer sows his seed with the same end in view, "profit." Nature makes the seeds to grow, but without attention from the farmer, but a poor crop would be gathered in. We buy poultry, feed and attend them, and profit by their eggs and increase, but we get none of these advantages without a proper share of attention and expenditure. Thus with Bee-keeping, thousands of Bee-keepers in England, belonging to the agricultural labouring classes, keep Bees, give them the minimum of attention, and make but small profit; and the educated Bee-keeper, unless he follow a more rational plan, must not expect a better result. Mr. Pettigrew, in his *Handy Book on Bees*, wherein he advocates the use of straw skeps only, talks of the contents of these hives

commonly weighing from 100 to 150 pounds, and instances a swarm in its first season reaching 160 pounds in weight; he also states that at a village in Lanarkshire, the profits of Bee-keeping averaged in six consecutive years, £2. 11*s.* 8*d.* per hive. I can only say I never saw such hives, and none made their appearance at the first Crystal Palace Show, where they could not have failed to take many prizes; and the Bee-keeper who allows his expectations to rise to this height, will be grievously disappointed, more especially if he repudiate the use of all the improvements of modern times, the result of the collective experience and wisdom of able and truth-telling observers. Very strong stocks have been known to gather 10 or 12 pounds per day during exceptionally good honey weather; and a skilful Apiarian in a good honey locality and season, by the expenditure of ceaseless care and attention, may, perchance, with a strong stock of Bees, obtain a super of 80 or 100 pounds of pure virgin comb.

> "Huge honeycombs of golden juice,
> Not only sweet, but fit for use."—VIRGIL.

This is a feat to be proud of, but years may elapse before such a result is attained, notwithstanding the devotion of unlimited time, and the exercise of special skill in fostering, which the many are not able to bestow.

An average price for a good swarm of English Bees, we may set down at 15*s.*, a little more or less, according to the abundance of Bees in the neighbourhood. If we allow 2*s.* per annum for capital expended on a good frame hive, not a fancy article, and 3*s.* for sugar in hard times, we shall have an annual expenditure of 5*s.*,

and the stock, after the first year, may be fairly expected to return one swarm, value 15*s.*, and say 20 pounds of honey, value 20*s.*, a very large profit on the capital employed setting aside exceptional years when two or more swarms will come off, or the super of 50 pounds or 100 pounds that, possibly, may gladden the eyes of the exultant Bee-master, also the contingency of the swarm in its first year, giving a surplus in honey or virgin swarm.

Is not this profit enough to satisfy all but the most grasping usurer? A labouring man residing in almost any rural district may keep quite fifty hives of Bees, without interfering with his ordinary occupation; it is not necessary that his own garden should contain them all; the country clergyman or squire would, in nearly all cases, obtain or give permission for the standing of hives in their woods, fields, or waste grounds, and feel pleased at being able to assist in the industry of their poorer neighbours. The thousands of railway servants, station-masters, porters and signal men have splendid opportunities of increasing their incomes by Bee-keeping; the Bees would prosper on, and gratefully accept, the shelter of the railway banks, which are generally clothed with flowers in all the luxuriance of their untended wildness; and amongst the passengers using the stations would be found willing customers for the honey and swarms. Those who can make, buy, or borrow a "Honey Extractor," will derive a far larger profit, if using frame hives; and such an instrument may be the joint stock property of a whole village travelling from one apiary to another. But there is another kind of profit besides that of money. Who but those who have experienced it can tell of the large

fund of instruction, pleasure and amusement, afforded by the busy Bees.

The industry and activity of Bees in their domestic labours afford an instructive and amusing spectacle. All are actively engaged; each attending, with all its power, to the business to be done. Some feed the young larvæ, others seal them over when full fed. A certain portion attend upon the Queen; then there are the cell builders, and the mighty moving army of honey and pollen gatherers. No skulking, no idleness; each Bee knows what it has to do and does it. Many employments are there in a hive; some Bees ventilate, others perform all the operations of scavengers, so that by night and by day work goes on unceasingly in this busy home of industry.

> "Behold! yon bord'ring fence of sallow trees
> Is fraught with flowers, the flowers are fraught with Bees;
> The busy Bees, with a soft murmuring strain,
> Invite to gentle sleep the labouring swain."—VIRGIL.

No need to stray from home in search of recreation in our idle hours, the Bees will teach us these should be unknown. Employment and interesting instruction will always be found in the careful watching for the welfare of the stocks in fine weather, and when the elements are unpropitious our ideas may be enlarged, and our mechanical genius fostered by the manufacture, improvement and invention of hives and appliances. In the long evenings of winter all may be got ready for the summer's requirements.

Many of our ablest Apiarians whose means permit, are content to sink pecuniary profit, and devote all their energies to the philosophical study of the mysteries of our industrious little friends and their

works. Some Bee-keepers also aim only at increase of Bees, finding the sale of these pay better than honey; and, as a rule, it may be taken as correct, that if the breeding power be unduly pushed, the storage of honey must be sacrificed.

CALENDAR.

THE Bee-keeper of experience wants no calendar to tell him what to do as each month comes round, but one may be very useful to the novice, reminding him of something he would otherwise have forgotten to the detriment of his apiary and, consequently, of his pocket. In the following compilation much of necessity will be repetition which the importance of its remembrance must excuse.

JANUARY.

DURING this month Bees are best left in perfect quietude. See that the hives are well sheltered from wet and snow; and, in the event of the latter falling heavily, do not omit to clear it away from the entrance of each hive. Bees, like human beings, cannot live without air. Should a bright sunny day tempt the Bees abroad while snow is on the ground, numbers will be observed to fall on it, never again to rise; and it is as well at such times to shade the hive from the glare of the winter's sun. Tomtits now finding insect food scarce will, probably, wait upon the Bees and catch and swallow many. Should these marauders be noticed, a small piece of wire netting, bent crescent-shape and placed before the hive's entrance, will baulk them. Now is the time to consider and decide on the hives and apparatus we shall require in the summer, and orders should be given for them if they have to

be bought; many people omit this until the time to use them arrives, when, to their disappointment, they find the demand exceeds the supply. Take great care the stocks are not disturbed, undue excitement in bad weather being very injurious.

FEBRUARY.

In this month we generally have a week or two of mild warm weather, and when it occurs take advantage of it to make an examination of the stocks with as little disturbance as possible. Let each hive be carefully and quietly lifted off its floor board, which should be nicely and quickly scraped clean before the hive is returned. Note the amount of stores left in each hive and, if absolute poverty is found, feed with barley sugar; it is as well not to give too much liquid at this season as it will tend to make the hive cold and damp. Should any stock be found to have died, clear away all the defunct Bees with as little delay as possible, examine the depopulated hive carefully for indications of foul-brood, and, if none be found, wrap up the hive with its combs in a cloth and put it away for future use; it will be found very useful in swarming time. Usually in this month the crocus blooms, and from that flower the Bees, on warm days, will be observed bringing home pollen; wherever this is seen it is a certain indication that the Queen is living, and breeding going on. The children of the household will find a great fund of amusement watching for pollen gatherers, and great is the glee when another hive is marked as all right with a reigning monarch. If you buy Bees this month, select a stock where

pollen is actively brought in. Rye flour may now be given as artificial pollen. If the cold weather appear to have passed away, stimulative feeding may be resorted to. (See "Feeding.") Our aim now should be to fill our hives with brood and then early swarms will come off and supers be filled.

MARCH.

If examination of the stocks was not made last month let it be now done, of course selecting a fine warm day. Bees driven abroad in cold weather get chilled and fall to the ground to die, therefore never disturb them unnecessarily in cold weather. Let all stores of hives, &c., be looked up and thoroughly cleaned.

Bars and frames should receive their guide combs, and if hives to be purchased are not ordered let it be now done. As the spring advances the Apiarian will find other work to do. Continue stimulative feeding. The entrance of a little food into the hive sets the Queen breeding, and the Workers pollen gathering. Where bar-frame hives are used, it is a good plan, towards the end of March, to shave off the seals of the honey caps, and return the combs wet with honey to the Bees; they will imagine harvest has come, and eagerly lick up the oozing honey and repair the damaged combs. If any portions of the combs are mouldy, pare such parts off, and a better atmosphere will be insured to the Bees. Generally attend to all sanitary works, if you would have your stocks thrive. Bees can endure cold, but not damp. Sow your sweet flowers to blossom in the autumn when wild flowers are scarce.

APRIL.

Now our Bees are busy at home and abroad; vigorous Queens are filling their cells with eggs, and a great strain is on the Workers to feed their numerous charges. Large quantities of food are consumed, and we should assist the Bees with a bountiful supply, at the same time taking care that we do not give over much, for the Bees may in that case fill the cells with it and not leave breeding-room for the Queen. Stocks do sometimes perish from over prosperity. As the fruit trees blossom, so may artificial feeding be discontinued; and those hives that are populous and rich may have a super placed over, duly provided with guide combs, and warmly wrapped up. If the Bees work vigorously in the super, it is probable the hive will not swarm, although this is not invariably the case. Should any stock now be found inactive while others around are busy, probably the Queen is dead. Another must be provided, or the Bees driven out and added to another stock, the hive of combs being carefully preserved.

Occasionally, in April, a swarm may issue; we should, therefore, be prepared for its reception. Should the weather be dry, and no water near, some should be provided for the Bees; for while the young are feeding, much water is consumed.

If scientific Queen-rearing is to be attempted before Drones can naturally be expected, early this month, if not done before, Drone comb should be placed in the centre of the brood nest of some selected hive; this the Queen will fill with Drone eggs, and twenty-five days thereafter the gentlemen will appear. (See chapter on "Queen-breeding.")

MAY.

"A SWARM of Bees in May is worth a load of hay," is a very old saying; but I fancy hay must have been cheaper in those days. Now if May is fine and genial, the sooner we get our swarms the better; so that the practical Apiarian will do well to watch carefully his stocks, and as waiting for natural swarms is tiresome and costly, every hive that seems too full should be artificially swarmed, and the chapters on "Swarming" carefully studied. If the month be cold and wet, the old hives are better left well populated; for, if a swarm be made, it becomes a trouble and annoyance, requiring constant attention in feeding, and even then it will not do so well as one which comes off in finer weather, although, perhaps, two or three weeks later. Whenever clustering at the entrance of the hive is observed, which will only happen in fine weather, wait not a day, but form an artificial swarm. If you have never performed that operation, do so now; everything has a beginning, and what at first appears a formidable thing, afterwards becomes simple and easy. What is more tantalising to a Bee-keeper than to see one or two quarts of Bees idly hanging out of their hive for two or three weeks, while he is anxiously waiting for a swarm which, perhaps, after all, never comes. Where swarms are not desired, attend to the instructions for supering as last month. Never forget that if unfavourable weather ensue after a swarm be hived, food must be administered or they will starve.

JUNE.

IN June the Bees are all activity—swarming is in full progress and honey gathering also. Remove supers as

filled and supply others empty. Careless Bee-keepers often lose much by neglecting to do this in season, thereby condemning their Bees to unwilling idleness. As every swarm leaves its old home, supply the latter with a young Queen or ripe Queen cell, if possible, thus saving time, and time is money. Strengthen weak stocks by adding casts to them.

Every hive that has swarmed and not been supplied with a fertile Queen should receive a thorough examination to make sure the Bees have succeeded in raising a monarch; should this not be the case, if left to itself, the colony will infallibly die. In the matter of supplying Queens in proper season the skill of the advanced Bee-keeper is shown.

Dzierzon says: "It may often be important to "know from which hive the swarm has issued. After "it is hived and removed to its new stand, let a cup "full of Bees be taken from it and thrown into the air "near the apiary; they will soon return to the parent "stock and may easily be recognized by their standing "at the entrance and fanning like ventilating Bees." This may be improved upon by powdering the Bees with flour before loosing them, or by adopting Sir John Lubbock's plan of marking Bees. All swarming should be now over; only at exceptional times will later swarms do any good. Bring the extractor into requisition, if available, to give breeding space as well as to obtain the surplus honey.

JULY.

Narrowly watch the supers to see when storage ceases, which generally happens this month, unless at

the heather. When this is determined, let them be removed or the Bees will carry the honey down to the hive as their stores there diminish; also see that the stock hive is not filled by a glut of honey to the loss of egg laying space. Those who use extractors can easily make room by slinging out the honey.

AUGUST.

If you have a large area of heather near, now is the time to send your hives there for their second harvest, which will often exceed the spring and summer gathering. If this plan be not available, decide which stocks are to be retained, and to them add the Bees to be driven from the others. (See "Driving.") Utilize every scrap of brood by piling it right way upwards in a small super, and placing it over the feed hole of another hive. Any large pieces of brood comb may be filled into a frame, and inserted in its place within the frame hive. If you have any weak stock, seek out the cottagers who slaughter their Bees by the barbarous fire and brimstone method, drive out the Bees for them instead, taking the poor castaways for your pains, which add to your weak stocks, thus doing yourself and your Bees good, and teaching the ignorant to mend their ways. Driven out Bees may often be bought in rural districts at about 1*s.* per pound, and are well worth the money to the advanced Bee-keeper.

SEPTEMBER.

Now finish all the honey-taking left undone, as well as any other work of the last month. Bring home

stocks from the moors, and begin to prepare for winter. During this and next month Ligurian Queens are procurable at the lowest price. Should you desire to Ligurianize your stocks by means of imported Queens, now is the time. (See chapter on "Ligurians.") Select your finest supers for exhibition and competition at the Show of the British Bee-keepers' Association, which do not fail to attend, and the experience and information gathered will amply repay you. Practical demonstration goes a great deal further than oral or written teaching. Weigh all stocks; all that have not at least twenty pounds net contents should be fed up to that weight; the Bees are still active and will carry in food fast. Hives may be easily weighed by one of Salter's spring balances or a steelyard; put round the hive a cord and hook the balance into it, a skep may be turned up and the hook attached to its lower margin. Cold weather may set in any day, remember delays are dangerous. Trap wasps and take precautions against robber Bees. Should Drones now appear in any hive, be sure that hive has an infertile Queen or none at all; in either case supply it with another, or unite its inhabitants to a neighbouring stock.

OCTOBER.

Complete work left undone last month and prepare every stock for wintering; see that covers and warm padding are furnished to every hive requiring them. Narrow the entrances and make all snug for the winter. Carefully preserve spare combs for next season; clean and dispose of supers and all the summer's litter. Where the hives can be gradually

withdrawn to the shelter of an open barn it will be worth doing; they may be moved two or three feet per diem, and thus no Bees will get lost.

NOVEMBER AND DECEMBER.

All work should now be over and the Bees be warm and comfortable in their winter quarters, where they should be left undisturbed till February. Guard against the depredations of mice and tomtits; and, in the long nights of winter, make up your Apiarian Journal and communicate your useful experiences to the periodicals whose columns are open for that purpose—and then REST AND BE THANKFUL.

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